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GERMAN CONDUIT ELECTRIC ROADS.

To those who have watched in this country the development of the electric-railway systems using open conduits, the description, on other pages of this paper, of the system which has found considerable use in Germany and Austria will be of great interest. This system differs essentially from American practice in the location of the conduit, which is immediately under one of the service rails, the rail being split, so to speak, into two slot rails between which run the plow and the flanges of the truck wheels. Compared with American systems with a centrally located conduit and yokes supporting the two service rails as well as the centrally located slot rails, the German construction is undoubtedly cheaper. About 100 pounds of steel per yard of single track is saved in the rails, and the yokes, as they need only embrace the conduit, are materially lighter. An incidental disadvantage of this, especially where the service is heavy, as it generally is where the open-slot system is used, is the fact that the track foundation is not as substantial, especially under the rail not over the conduit, as in the American construction, the solidity of the yokes of which, combined with the heavy concrete conduit and its extension under the service rails in the form of a foundation, make a track the depreciation and repair accounts of which are very low.

On a complicated system the use of a conduit offset to one side might give trouble, owing to the difficulty of always keeping the cars headed in the same direction. With many lines intermeshing in all directions and through routes over common tracks, some cars are bound to go around loops, bringing the contact plow on the wrong side. Of course, this can be remedied by crossing the conduit from one side of the track to the other at the proper switches, but this would require some very elaborate special track work and a special form of plow capable of traveling across the truck which does not seem to be provided in the German construction. With a central conduit cars can switch, back, turn around, go around loops or be manipulated in any way without losing their ability to take any track.

The most ingenious thing about the German roads is the self-folding plow, which can on occasion be forced up and out through the slot, narrow as it is, or lowered again into it, so that through service can be given by the same cars on lines with overhead and underground conductors, respectively. The narrow contact plates which thus fold up, of course, give a much smaller area of contact on the conductor rails than do the substantial flat cast-iron shoes used in this country, but even so, they probably give a contact of sufficiently low resistance for all practical purposes in street traction. The system is most completely worked out, the plow when it is ejected from the slot automatically cutting itself off from the car circuits and cutting in the overhead trolley, and vice versa when it again enters the conduit, the intent being that the car will not even have to stop, but may continue at practically full speed, while this change in the power-feeding mechanism is being effected. Whether the overhead system involves a double trolley or not does not appear. If not, and the two systems are supplied from the same bus bars, one pole of the underground conductors is necessarily grounded, thus losing one of the elements quite essential to continuous service with conduit roads, namely, the necessity of two grounds in one section for short circuit.

Another difference from practice in this country is the shorter interval without power on special work, especially switches. American practice in this regard is simpler, the conductor rails being simply discontinued at switches and crossings, the cars drifting through until, in the case of switches, the two branches of the conduit are sufficiently removed from each other for the insertion between them of conductor rails flared out to avoid carrying away the plow contacts. In the German system the conductor rails are provided with a switch tongue, as is the track rail above, the switch tongue having necessarily within it a section insulator, dwing to the change of polarity of its tip every time it is thrown, but this section insulator gives the car lights at night but a brief wink compared with the period of darkness on American roads, especially when running slowly. The German construction of this detail is of necessity more complicated, but the results are undoubtedly more satisfactory.

INCREASING THE PRESSURE FOR ELECTRIC-RAILWAY DISTRIBUTION.

The available drop on electric railway systems is so large a percentage of the total voltage generated that only under exceptional circumstances is "boosting" allowable from the standpoint of economy. Without it systems can be worked with 100 to 150 volts drop in the feeders, and if a greater drop exists than this it would generally be good policy to put in either more copper, other generating stations or some system of high-voltage transmission. But in certain cases, particularly where the load factor is extremely low, as often occurs with excursion lines not used at all for many months of the year, and only occasionally crowded while in use, it does not pay to incur any high fixed charges, and extreme loss at these rare times of heavy load is justifiable. For such work the pressure at the power station of the feeders is generally raised by what are called boosters, sometimes by as much as 100 per cent.

The arrangements of these boosters are various. Where the service is only occasional it is best to arrange one of the regular 500-volt generators for such work. This can be done by means of ordinary throw-over switches, which in one position connect the generator in multiple with its fellows, and in the other in series between the main positive bus and the feeders supplying the districts where a high voltage is desired. In this way a compound-wound machine is obtained, and, as the desired increase in pressure is rarely 100 per cent. of the normal the shunt field can be made very weak, giving on no load a low voltage which rises rapidly with the load, owing to the action of the series coils. This rise in volts will be much more rapid per ampere than with the shunt fully energized, owing to the steeper inclination of the magnetization curve below than above full shunt excitation, and in this way the variations of the line-drop with varying current can be automatically compensated without complicated apparatus. Boosters built especially for such service are often series-wound to give added voltage above that of the bus bars very nearly proportional to the line-drop.

For use with storage batteries, however, the conditions are somewhat different. With the battery installed in the station itself, it is obvious that if simply connected across the line the over-compounding action of the generators would increase the voltage and consequently increase the charging current of the battery with increased load and decrease it with decreased load, thus making the battery increase the load fluctuations instead of diminish them. This can be remedied either by the use of end-cell switches or a booster. The former method is rarely used in traction work, as the fluctuations are too rapid for the switch mechanism to follow, and the latter, the booster, being differentially wound, is now the common solution.

With the battery in a sub-station the case is different. Owing to the feeder drop the voltage may fall with increased load at the feeder terminal in spite of the over-compounding action at the station, and in this case the battery would without any booster whatever give a steadying action to the load, taking current when the load is light and discharging it when the load is heavy. As a rule, however, battery sub-stations are installed at a distance from the main station so great that without excessive outlay for copper the bus-bar voltage would not be sufficient to maintain a proper line voltage at the battery sub-station even with the steadying action of the latter. In this case boosters are used to raise the pressure on the feeder supplying the battery. Here series machines or compound-wound machines with weak shunt fields are dangerous, owing to the risk of reversal of the current, in which case the machine voltage also reverses, tending to help the battery discharge. The danger only exists when the voltage generated by the shunt excitation of both main generators and boosters is less than that of the battery, the voltage due to the series excitation being at all times less than the feeder drop. For example, if the station generators build up at no load a pressure of 500 volts and at full load 600 volts, the storage battery should not have an open-circuit pressure above 500 volts. In case it does, it will sooner or later reverse the line current, build down the dynamo voltage by means of the series field and cause trouble.

ELECTRIC CANAL TOWAGE.

An English contemporary, "The Electrical Review," in discussing the decadence of canal traffic in Great Britain, describes conditions somewhat parallel with those that obtain in this country, where the same disuse of the once busy canals is noticeable. According to this authority the facts underlying this decadence are that at the time of the appearance of railways popular interest forsook the canal in favor of its rival, and that the canals in great measure passed into the hands of the railway companies; that there was never a systematic development of trunk-line canal systems, and hence never a fair competition between the water route and the land line. These all seem to apply as well to conditions here as there. Whether the remedy is to be found in electric towage remains to be seen, but the promise of success is at least sufficient to encourage far more comprehensive experiments than any that have yet been undertaken.

In brief the canal problem differs from that offered by the equipment of a railway by the total absence of grades on a canal, and the very small power required to move great burdens of freight at the low speeds made necessary by the limitations of this form of transit. The system of animal towing in vogue since canals were first dug is more suited to the days of the first navigators of these ditches than now. It has been proven that horse transportation is the most expensive kind when goods or passengers are moved on rails, and the growth of the automobile has already given data that go to show the same thing when it is a question of transit over roads. It is a fair presumption to assume that it is equally true of the moving of canal-boats.

Propeller boats raise destructive waves in the confined waters of a canal, and the trolley problem presented by them is more than discouraging. Perhaps the best approximate solution of the haulage problem yet tried is the bank-towage system in vogue in Belgium and elsewhere in Europe, where an electric truck on the bank takes the place of the horse. If this truck can be controlled from the boat, as it easily may be, thus eliminating the cost of attendance, the problem is largely solved. How long it will be before America sees its canals provided with electric tramways on the tow-path is hard to foretell, but the day that sees it an accomplished fact will probably also see the canal once more take its place as a factor of importance in our industrial life.

ROUTE OF THE JUNGFRAU ELECTRIC RAILWAY.

The Jungfrau Electric Railway.

PERHAPS the boldest electric-railway undertaking yet projected is that now under construction in Switzerland, the upper terminal of which will be the summit of the Jungfrau, 13,670 feet above sea level. A short section of this road, 1.2 miles in length, has already been completed and was recently opened to the public, and from the account given by the special representative of the London "Electrician" the following information and illustrations have been in a large part taken. The road when completed will be 7.9 miles in length, with a maximum rise of 6900 feet, 240 feet of which is a vertical lift at the summit. The road starts from a station, known as the Little Scheidegg, of the Wengern Alp Railway, which is a rack and pinion road, with traction obtained by steam locomotives. The section already constructed is almost entirely on the surface, only 85 yards being in the tunnel, but the whole of the remaining 6.7 miles will be within the rock, under the Eiger, Mönch and Jungfrau Mountains, the line only touching the surface at the stations, which will be built within the rock and fitted with restaurants and other accommodations for the passengers. A view of these mountains and of the route is shown in the accompanying supplemental sheet. It is estimated that the railway will be completed by 1904. The whole line is on an upward gradient, varying in inclination from 6¼ to 25 per cent., so that should the power supply fail the trains can run down to the lower end of the line by gravity. Plans for the various parts of the work were obtained by an international competition, over $6000 being distributed in sixteen prizes.

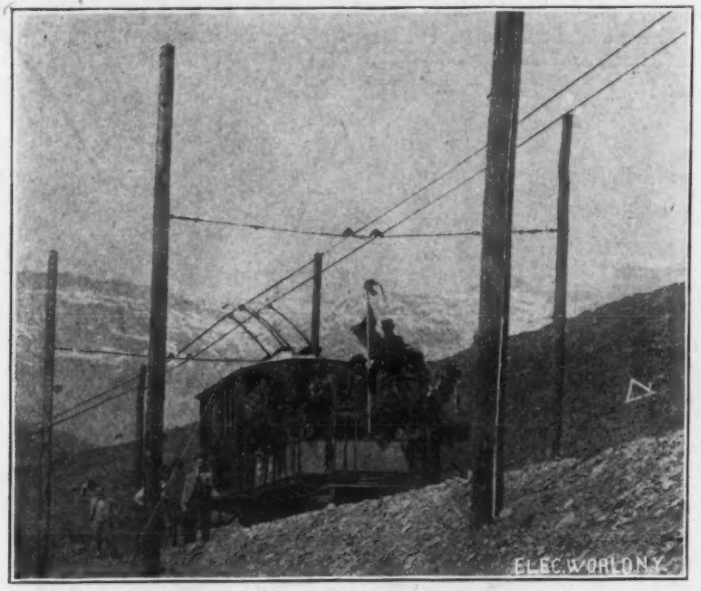
The Jungfrau line is one of the most interesting applications of three-phase transmission and distribution yet made. Water power is made use of in the valley to generate three-phase alternating currents at 7000 volts, and these are transmitted by means of an overhead line to transformer stations at the Little Scheidegg and the Eiger Glacier, where they are transformed to 500 volts multiphase by means of stationary transformers. Not only is electrical energy employed for traction purposes, but also for lighting, heating and for working the rock drills used in the tunnels. When the railway reaches a high altitude the energy expended in heating the trains and stations will be an important part of the total demand.

At present only one power house has been built, this one being situated on the White Lütschine, near Lauterbrunnen, down in the valley. The power-transmission line from Lauterbrunnen to the Little Scheidegg is about 4½ miles long. The three wires are of bare hard-drawn copper wire, 0.3 inches in diameter. They are supported on triple-petticoat insulators, about 4½ inches in diameter and 7 inches high. Stout wooden poles, about 33 feet long, are used, with galvanized iron brackets. Whenever the wires cross a footpath they are nearly surrounded by a circular guard-net of very wide mesh, intended to prevent a wire from falling to the ground in case of breakage. A metallic-circuit telephone line is fixed on the same poles, some distance below the three-phase wires, and the two telephone wires are transposed every 550 yards to avoid induction. Lightning protectors of the Siemens & Halske horn-shaped pattern are used on each of the power-transmission wires, as well as on the secondary trolley wires. The fall of potential in the transmission line will be about 10 per cent. at full load.

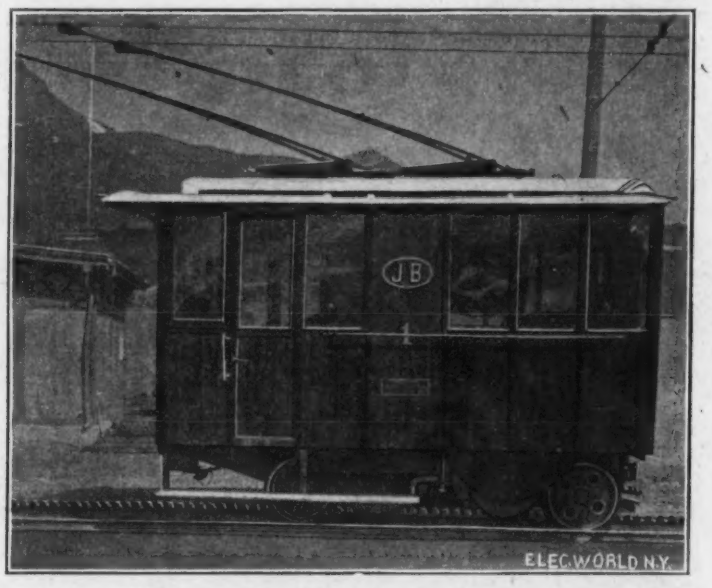
The transmission line is not duplicated, so that if it were interrupted all power would be cut off from the railway. A duplicate power station is projected, however, at Burglauenen, near Grindelwald, on the other side of the Wengernalp, capable of supplying some 2600 horse-power, which is to be furnished by the Black Lütschine. This will feed the Little Scheidegg transformer station through an independent transmission line of similar construction.

The sub-stations are substantial stone buildings, designed to withstand the action of the most inclement weather. They are each fitted with two 200-kw transformers, reducing the pressure to somewhat over 500 volts for the secondary feeders. The latter are of hard-drawn copper and are constructed in a similar manner to the transmission line. The transformers were built by the Oerlikon Company. The fuses are of copper wire outside the sub-stations. In addition there are rotary transformers at the Eiger Glacier station which supply continuous current for the rock drills and lighting. When more of the line is built transformers will be added every thousand yards.

The permanent way is built on the Strub rack system. Metre gauge (3 feet 3⅜ inches) is employed, the rails being of the usual T pattern, about 4 inches high and weighing 40 pounds to the yard. Steel sleepers are used, their distance apart averaging about 3 feet 3 inches. The rack, which is, as usual, midway between the rails, is of steel, rolled solid with the teeth cut afterward in the cold bar. It is made in lengths of 11 feet 6 inches and weighs only 68½ pounds per yard. Its mean tensile strength is 28½ tons per square inch, with an elongation of 20 per cent. The inclined sides of the rail and teeth of the rack permit the use of an emergency brake which clutches them on both sides. As was mentioned above, one section of the projected line will have a gradient of only 6¼ per cent., and here it is anticipated that no rack will be needed. The sharpest curve of the section of the line now opened has a radius of 33 feet, and the sharpest curve in the tunnel will have a 66-foot radius. Two Chicago bonds of 0.28-inch diameter are used for each rail joint, and the rails are cross-bonded every 55 yards with 0.32-inch rods.



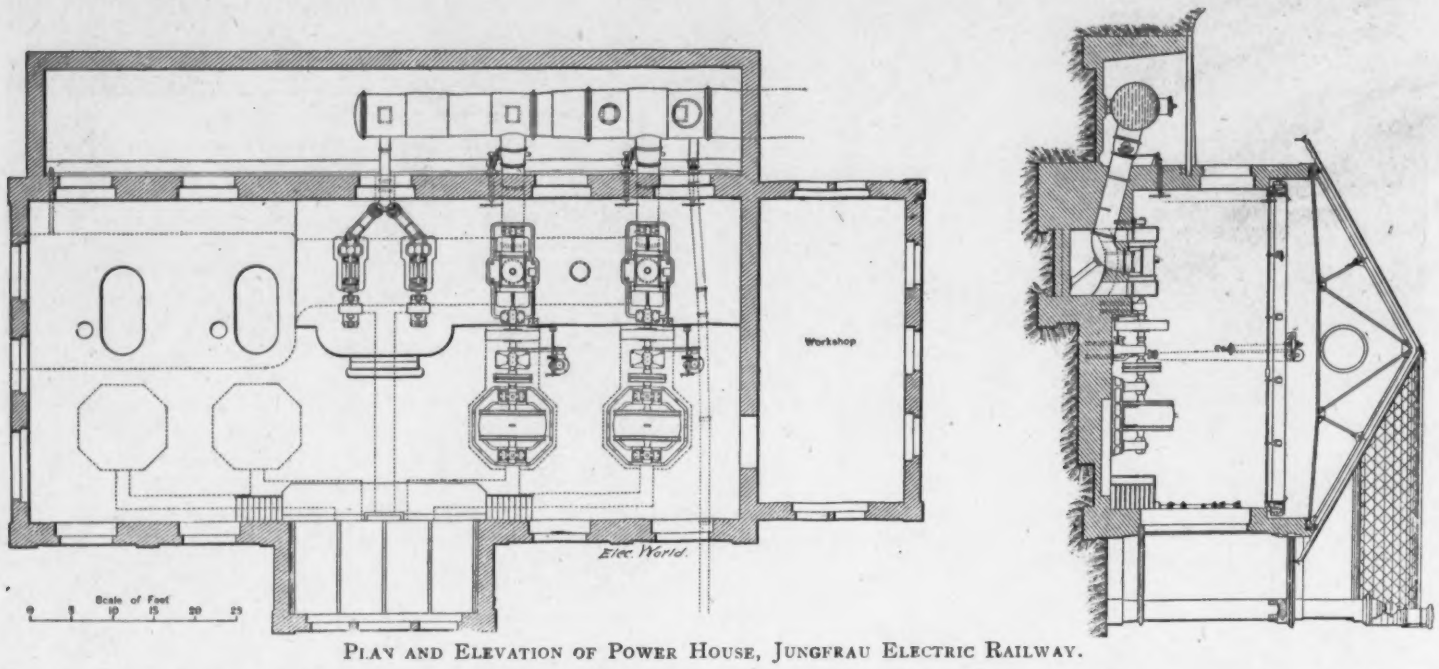
A SCENE AT THE OPENING.



A VIEW OF THE LOCOMOTIVE.

The locomotive has been built by the Société Suisse des Locomotives, with motors by Messrs. Brown, Boveri & Co. It contains two 125 to 150-hp induction motors driven directly at 760 revolutions per minute by the 500-volt three-phase current, with a frequency of 38 cycles per second. Each motor drives, through double-reduction gears, a cogwheel meshing in the rack. The weight of each motor is 2.6 tons and the locomotive complete weighs 13 tons.

a centrifugal governor, when a speed greater than a certain maximum is reached, the current is automatically switched off from the motors, and at the same time a band-brake is set on each of the motor shafts. A dashpot prevents slight momentary increases in speed from putting the brake in action. This brake can also be applied by the guard in the passenger car, who is provided with a switch to cut off the current. The second is a hand-brake, which

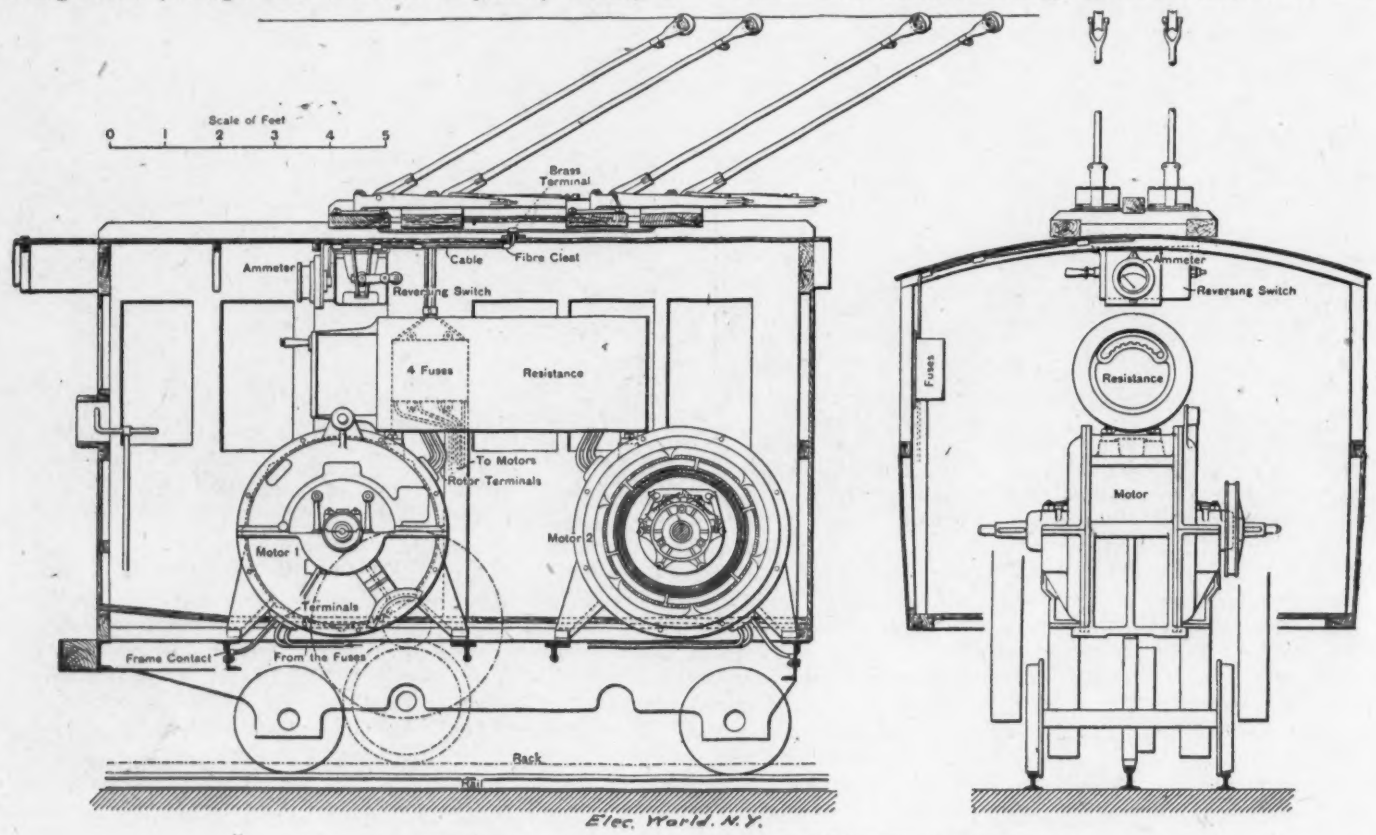


Plan and Elevation of Power House, Jungfrau Electric Railway.

One advantage of the three-phase system on such a railway is the simple automatic braking action of the induction motors. When the locomotive is going down hill the motors act as generators when their speed exceeds synchronism. From the plan of the connections it is plain that the motors are merely controlled by a reversing switch (through which the stator or primary winding is

applies bronze shoes to grooved pulleys, one on the shaft of each of the two main gear wheels meshing in the rack, and the third, which has been already referred to, is an emergency brake which grips the rack. This brake is also lined with bronze and it can be applied either by the driver or the guard.

There are six incandescent lamps on the locomotive, two in series



Sectional Elevations of Locomotive, Showing Electrical Equipment.

connected to the line) and the usual rheostats in the secondary circuit to avoid starting the rotor on a short circuit. This group of rheostats is mounted in a large cylinder over the motors.

The locomotive is fitted with three absolutely independent brakes. The first is an automatic one, electrically controlled. By means of

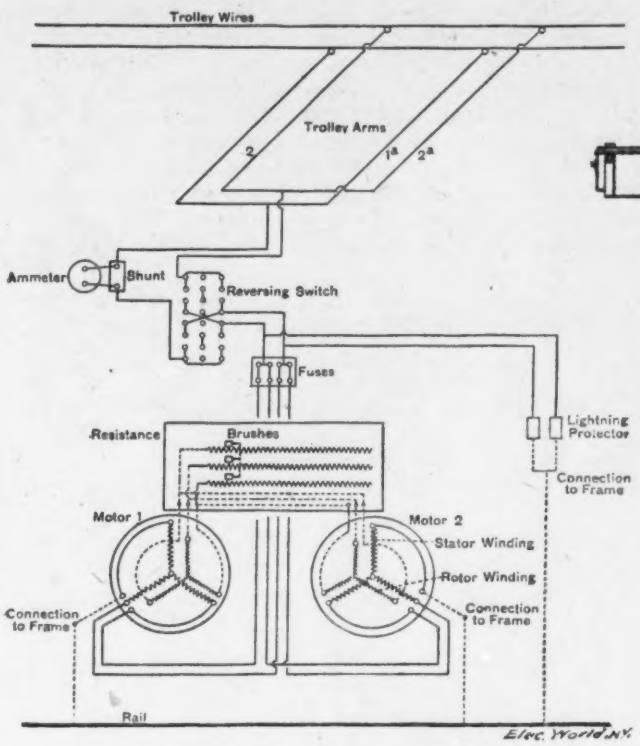
on each phase, and the passenger car will be lit with fifteen lamps, five between each pair of wires. Two trolleys are employed on each wire on account of the large currents which have to be transmitted to the locomotive.

The passenger cars, which cannot be called trailers, as they are

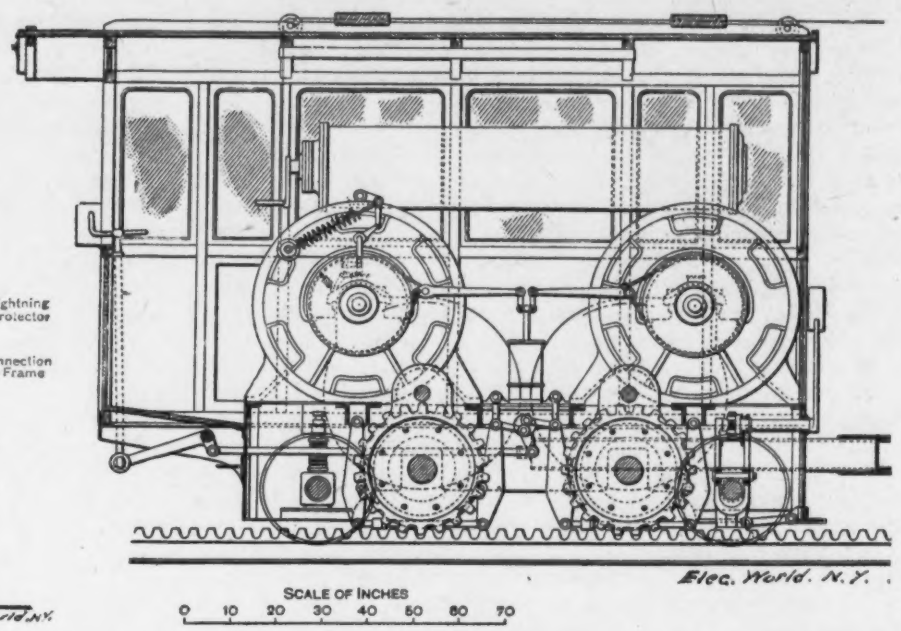
pushed, not pulled, are built for forty passengers. Each train will usually consist of a locomotive and one car, but at times of exceptional traffic a second car will be added. At present only two trains will run, one up and the other down.

The turbines of the power plant at Lauterbrunnen work under a head of 115 feet, the water being delivered through a steel pipe line about 1500 yards in length and about 6 feet in diameter.

The accompanying figure shows the power house in plan and elevation. It is planned to have four main generating sets, each of 500-hp capacity, but only two of these have as yet been installed. The turbines, made by the J. J. Rieter Company, are of the twin, axial-flow Girard type, with central admission and outside delivery. They stand over the tail-race and the water is delivered to them from below, thus clearing the dynamo room of all piping. They run at 380 r. p. m. and are direct-connected through flexible couplings to three-phase inductor generators of the Oerlikon make, delivering three-phase current at the full line pressure of 7000 volts and 38 cycles per second. Two exciters are installed coupled to independent turbines.



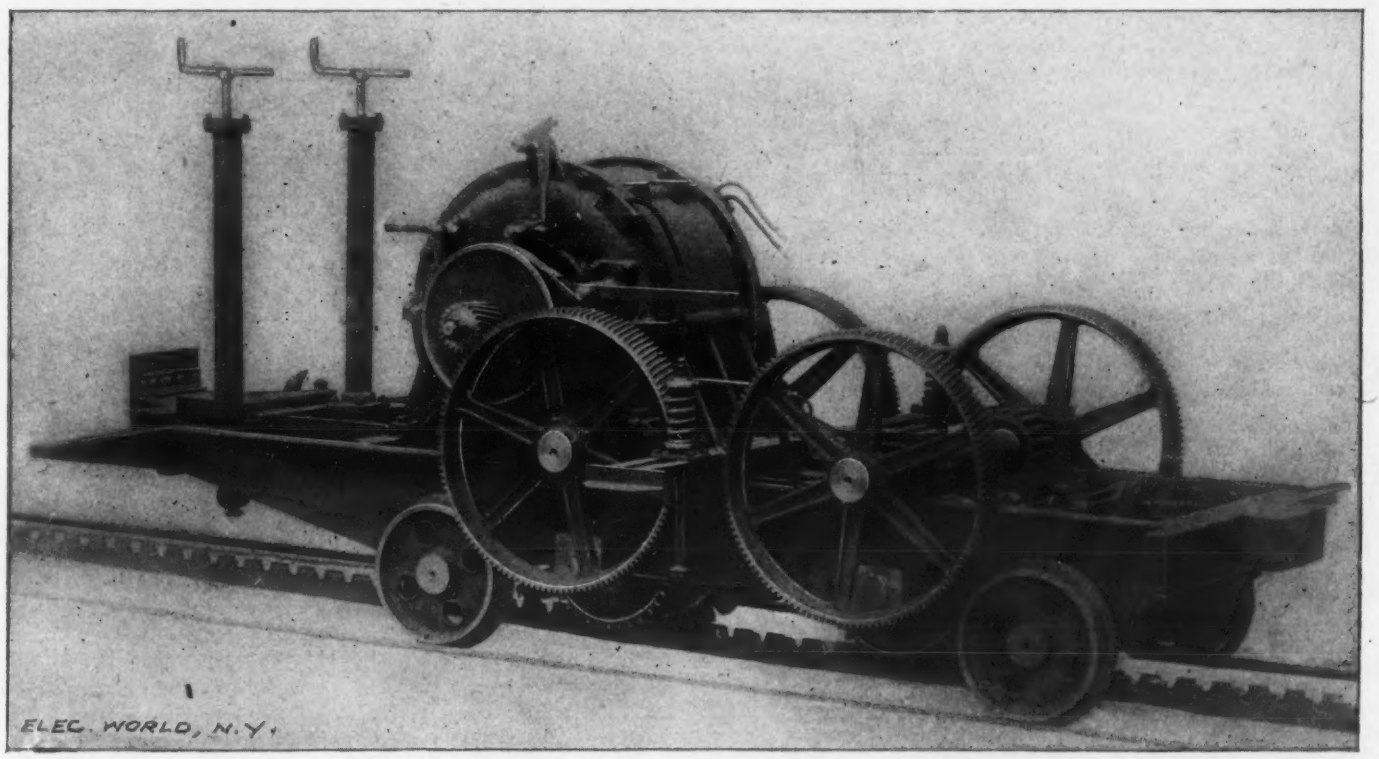
THE CIRCUITS OF THE LOCOMOTIVE.



SECTIONAL ELEVATION OF LOCOMOTIVE, SHOWING GEARING AND BRAKE MECHANISM.

Telephonic Direction of Vehicles.

A unique feature of the Knights Templar conclave, which takes place in Pittsburg from October 11 to 15, will be the means adopted for handling the crowd at the reception to take place at the Duquesne Garden. Near the main exit there will be a booth having a telephone switchboard, from which eight lines will be carried out to as many booths, in different directions, three or four blocks distant. A man is to be stationed in each of the smaller booths, while just outside the door there will be a policeman with a large megaphone. When the ball closes and carriages are wanted the man at the switchboard in the ballroom will call out the vehicle number to each one of the stations.



LOCOMOTIVE JUNGFRAU ELECTRIC RAILWAY, SHOWING ONE MOTOR IN PLACE.

The Use of Electricity in the Spanish-American War.*

BY THOS. G. GRIER.

The application of electricity in the army and navy for their various and many purposes is recent, but its progress is rapid. The object of this paper is more to note the uses than to describe the details.

The fortification board established ten years ago by the United States Government has developed complete and elaborate plans for the equipment of coast fortifications. In these plans electricity plays a very important part. Submarine mines connected by cable with harbor forts have been planted, electric light and power stations have been installed, searchlights, motors, telephones, telegraph instruments and many other devices have been used in preparing for the defense of our harbors.

Range finders for determining distances were extensively used; these instruments may be dependent upon electricity for their operation, as in the case of the Fiske range finder, or may be operated mechanically. Just prior to our recent war with Spain 200 Lewis depression range finders were ordered by the United States Government to equip our various fortifications. While these instruments are operated mechanically their efficiency in action depends upon the application of electricity in communicating the distance observed to the gun captain or commander.

To condense as much as possible, a brief summary of the applications can be given by describing the methods employed at Fort Wadsworth, which lies just below New York City. In this fort the fire commander directs the attack from a sheltered station equipped with a Lewis range finder. There are also a position-finder station and four battery-commander stations. The fire commander is in direct communication with all by means of telephones.

In the position finder's station, together with numerous other instruments, are a dial telegraph, electric clock and telephone. One of the guns is equipped with a dial telegraph and another with a Sheehy teleotype, an instrument which indicates the azimuth or angle from a predetermined line and gives the range or distance in yards the observed vessel is from the fort. All of the commanders' stations are, however, connected with the guns both by speaking tubes and telephones.

Observations are signaled to the guns, and the course and speed of a ship are plotted upon a miniature representation of the harbor. By means of an electric clock placed at every station absolute uniformity of time is obtained, and the probable course and range of a vessel for several minutes can be plotted from these observations, and without even seeing the vessel the gun can be elevated for the range and trained for the proper angle, and by means of a stop watch the order to fire given so that the shot will fall upon the deck of a vessel whose course has been observed by men at a distance from the guns. The introduction of electricity for signaling has given this wonderful control to the fire commander over his batteries.

Sandy Hook, at the mouth of the harbor, is connected by cable with Fort Wadsworth, and the approach of hostile ships may be telegraphed to the fire commander so that their course may be watched and the fort prepared at the proper time to do justice to the work before them. Sandy Hook was also placed in telephone communication with Washington during the past summer, so that the Government was in position to receive or send messages to the fortifications.

Fort Wadsworth has two 60,000-cp searchlights to sweep the harbor and guard against the approach of vessels on dark and stormy nights. An electric light and power plant forms a portion of the outfit, with a reserve storage batery to supplement the power station.

The channel above the fort is mined, and should some of the vessels of a hostile fleet pass the guns of the fort the observer at the submarine station would be plotting the course of nearby ships, by means of range finders or by information furnished him by the fort, and at the proper time fire the mine and sink the remnant of the fleet.

The mining of the harbors was an important part of our coast defenses, and the greatest demand for electrical wires and cables was for "torpedo cables" for use in submarine mines. It seems that our coast defense department has for years requested that an appropriation be made for cable, but the appropriations have been so cut down that not more than 5 per cent. of the amount needed was carried on hand by the Government. There are two styles of cables of seven conductors which are used to connect the shore end to a junction box in the channel, and a single conductor cable which connects each conductor in the multiple cable to an independent mine, each conductor being numbered. Any mine may be exploded at will from the shore.

When war was declared each of the manufacturers of submarine cable in this country received orders for all they could make in thirty days, and some were kept busy for sixty days, producing, probably, 200 miles of multiple cable and 200 miles of the single conductor. This has been distributed from the Bay of Fundy to Florida. Some was sent to the gulf cities and some to California, Oregon and Washington. One hundred and fifty miles of each size was under contract in the early part of August. The cost of seven-conductor cable averages about $1500 per mile, and the single conductor about $450 per mile.

Headquarters for work on submarine mines are at "Torpedo Station," Willets Point, Long Island, with Major John D. Wright in charge.

SUBMARINE MINES.

There are three different kinds of mines used in our harbor defense.

First. Observation mines, which are fired from shore when a ship is judged, by observation, to be within effective range of the explosive.

Second. Automatic mines, which are self-firing on being struck by a vessel.

Third. Electrical contact mines, which, on being struck by a ship, give notice on shore, and the operator, by the throw of a switch, fires the mines.

The methods of firing observation mines and electrical contact mines are similar. Automatic mines may or may not be fired by electrical means.

Mines may be placed upon the bottom of the harbor, and in such cases are called ground mines, and if they are contact mines the contact mechanism is contained in small buoys anchored at a depth below low-water mark just sufficient for them to be an obstruction in the path of vessels. When the channel is deep, buoyant or floating mines are used. A buoyant mine is more effective, as it lies nearer the object of attack, and for an equal effect does not require as large a charge of explosive.

MINES IN BOSTON HARBOR.

The shape and material of mines or mine cases are various, and the kinds employed at different points not always identical. However, a general description of the mines employed in Boston harbor will give a good idea of the plan and design used in all other harbors.

There were about 1000 mines planted in Boston harbor, covering the main ship channel and ingress to the harbor where vessels of over 12-foot draft could go at low water. The regular Government mine consists of an upright iron case about the shape of a top, with a strap on the bottom for holding the cable. Galvanized steel rope secured by an anchorage of any kind, in many cases of old horse-car rails, maintained the mines in position. The cable containing the electric wires runs up separately from the cable holding down the mines.

As the demand was urgent and no mines of the Government pattern were to be had, the engineers in Boston used new ale barrels, a hole being bored in one end for the receipt of the contact mechanism and cable. The barrels were encircled with rope to make a sling to hold them down, a flat steel ring being put around the rope so the steel anchor cable attached to it would not cut through. These mines were of different sizes and held from 100 to 500 pounds of explosive gelatin. Ordinary dynamite was used in some mines where there was not enough gelatin to be obtained. This was put in through a small hole in the top where the electric contact mechanism is placed.

The contact mechanism is connected through high resistance and by a battery circuit, using the cable and ground return for its conductors to an indicating and circuit-closing device located in the protected casement on shore. When a ship strikes a mine containing the device, deflecting the mine from its normal position, the battery circuit is closed; this operates an indicating mechanism which closes a break in the dynamo circuit and notifies the operator. To throw on the current for exploding a mine it is necessary to throw

*Paper read before Chicago Electrical Association, October 7, 1898.

in a switch or plug after the first break is closed by the indicating device. This circuit can be closed without any contact from the vessel at the will of the officer in the casement.

The firing switchboards at Boston contained an ordinary knife switch suitable for 500 volts, with springs which hold them open at all times except when held closed by the operator. These switches, one for each group of mines, were mounted on slate boards and plainly numbered with large letters. A dynamo developing one ampere at 500 volts, driven by an oil engine, furnished the exploding current.

The contact devices were made by the Anchor Electric Company and by the General Electric Company, the design being that

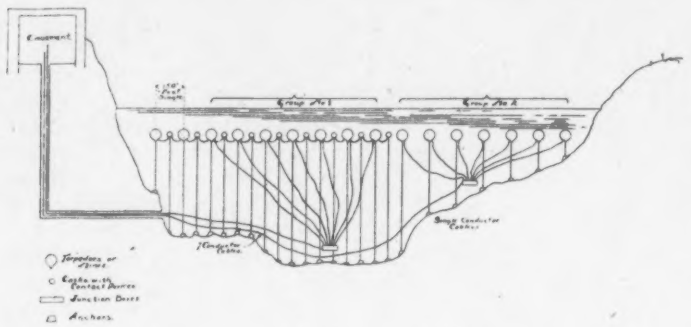


DIAGRAM OF MINES IN BOSTON HARBOR.

of the Government, with several alterations made by Dr. Louis Bell, the engineer in charge for the Government, to shorten the time of manufacture. All of the parts of the contact mechanism were of platinum or gold-plated brass to prevent any possibility of corrosion. The exploder consisted of a thin strip of platinum wire which was laid in a case of fulminate, which in turn was put in a case of dry guncotton; the remainder of the explosive was wet.

The mines were usually placed in groups of seven each, about 150 feet apart. These groups of mines in Boston harbor were strung clear across the channel and in the main channel there were three lines.

In this method, should a vessel be sunk by the first line of mines and the wreck not obstruct the passage for other vessels, the second line of mines would catch the next vessel and the third line the third vessel. Between the mines were small casks with contact devices connected to mines on either side. These were cheaper than mines, but were equally serviceable and made the line complete, so that no vessel could get through.

The submarine cables connecting the world's centres of population—a great system of electric nerves—had a most important influence in every feature of this war. Ships at distant points were enabled to advise and receive information, and movement of fleets could be directed from the seat of government. It is hard to conceive of this almost complete annihilation of time and space.

The Oregon, that speedy and modern man-of-war, equipped with powerful machinery, took eighty-one days to make the remarkable voyage from Puget Sound to Key West, a distance of about 18,000 statute miles, and of this time she was about fifty-nine days at sea. The distance by cable and telegraph from Chicago to Hong Kong is nearly as great, yet to send a message between these two points, including all the delays caused in the many transfers, requires less time in minutes than it took the Oregon days to make the trip.

Our army in the field has its cable tents completely equipped with telephones and telegraph instruments. The telephone at Santiago and adjacent points before and after the siege was of great service, and cable tents now have their names lengthened into the title of cable and telephone tents.

The Bishop Gutta-Percha Company, of New York, has furnished the Government with a special cable, which is used in the signal service by General Greely. It is very light and very strong, weighs about 60 pounds to the mile, and is furnished on reels in half-mile lengths—a two-conductor concentric cable. This outpost cable, as it is called, is carried by a scout on a reel fastened to his back like a knapsack. He carries a telephone, and one end of the cable being connected at headquarters enables him to communicate in whispers to his commander. An attendant accompanies the scout with extra reels, which are easily attached when the wire on the first reel has reached its limit. Telephones, in fact, are used everywhere—in forts, in camps, in the field, and on board vessels.

Among the most recent applications of electricity that found a place in the army and navy was the "X-ray" apparatus. It was used in the field, in the hospitals, and on the hospital ships. The Solace was equipped with the latest production of the Edison Manufacturing Company.

Notices were published in the papers of electric cooking outfits, which were going to be placed upon some of the hospital ships, and if it was done there is no doubt that much comfort and convenience resulted, especially when the vessels were in the warm climate of the West Indies.

Aboard modern men-of-war the electric light is found to be absolutely necessary for the efficiency of the ship. Searchlights are used to observe the movements of other vessels, to find buoys or landmarks on entering shallow channels, to pick up disabled boats or men overboard, to make landings, and for signaling. The incandescent lamps illuminate the entire ship, dispensing with oil lamps and candles; they are also used for night signaling.

Electric motors are used in hoisting boats and ammunition, for removing ashes, for steering, for training gun turrets and many other purposes. Steam whistles are opened and closed by electrically operated valves. The range for guns and the speed and direction of revolving shafts are indicated by the electric current, and guns are fired by an electric spark. Telephones and electric signaling devices aboard ship are extensively used.

This, in brief, covers the application of electricity ashore and afloat in the recent Spanish-American war.

A description of the principles governing some of the signaling devices on board ship will materially assist in showing to what a great extent modern vessels depend upon electricity.

The signaling and indicating devices used on vessels are: "helm indicators," "steering telegraphers," "speed indicator," "direction indicator," "range indicating system," "Fiske range finder," "azimuth telegraph" and "transmitter of orders." All of the devices consist of galvanometers, which indicate on their dials a difference of pressure, the dials being marked for the different offices the instruments perform, and with each instrument or system of instruments proper devices are used for altering resistances and consequently changing pressures to accomplish the ends in view. A description of the principle applied to the helm indicator will explain the operation in general of all the others.

The object of the helm indicator is to indicate, at different parts of the ship, the position of the helm. The principle of operation is shown in Fig. 1. Attached to the helm and insulated from it is a metallic contact, *A*, which presses continually on an arc of resistance wire, *C D*. At the centre of this resistance wire is a permanent contact, *B*, which is connected by a wire to one side of a number of galvanometers located at various stations. *E* and *F* are the negative and positive wires of the electric lighting system. Primary or stor-

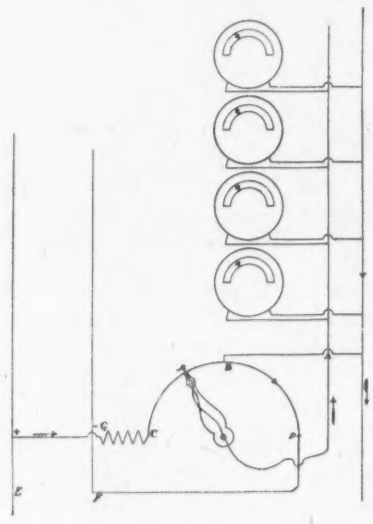


FIG. 1.

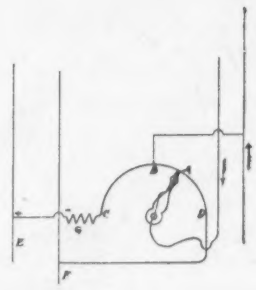


FIG. 2.

age batteries also could be used as the source of energy. A dead resistance is inserted in the circuit connected with the arc of resistance wire, *C D*, which reduces the current to about two amperes.

The current flows as indicated by the arrows. As the pointer, *A*, is moved toward the left, or toward *C*, the difference of pressure between *A* and *B* becomes greater and the flow of current through the galvanometer is greater. The galvanometers are adjusted so that

they take the same angle as the helm, or pointer, *A*. In Fig. 1, when the pointer is on the left of *B*, its pressure, as compared with *B*, is positive. When *B* and *A* are both in the centre, or when the pointer, *A*, coincides with the fixed point of contact *B*, then the needles of the galvanometers come to rest at zero or the centre of the scale. When *A* is moved toward the right, or toward *D*, then the conditions are reversed (Fig. 2), *A* becomes negative compared with *B*, and the current flows in the opposite direction in the galvanometer, bringing the needle toward the right. One of the instruments can be on the bridge, one in the captain's cabin, one in the wheelhouse and one in the conning tower.

The steering telegraph is the same arrangement of galvanometers, with a device for altering the resistance by hand. The captain sets the resistance from his station, having an instrument before him. The same indication appears upon an instrument in the wheelhouse, and by noting the helm indicator the captain is advised when his order is obeyed. The same thing is true of the engine telegraph, the transmitter for orders and the azimuth telegraph.

In the Fiske range finder the general principle is the measurement of the resistance of a conductor in the form of a Wheatstone bridge, there being two arcs of wire at the ends of a base line, corresponding to two contiguous members of the bridge. Two telescopes are located at the ends of the base line and carry contacts which move over the resistance wire as the telescopes are turned to be pointed upon any object.

In Fig. 3, let the arms, *a b*, of a Wheatstone bridge be represented by arc *h*, while *c* and *d* are bent into arc *k*, both of these

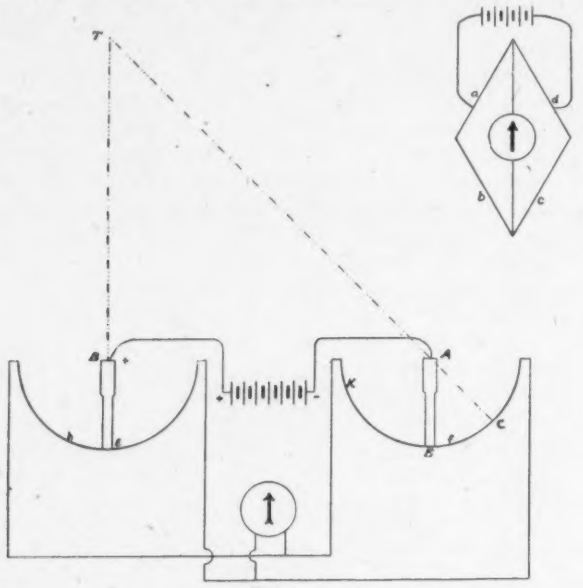


Fig. 3.

arcs being wires of conducting material. Let contacts, *e* and *f*, be attached to telescopes pivoted at *A* and *B*. When the telescopes are parallel and when at right angles to the base line, the galvanometer will not deflect and its point of rest is marked infinity. Now, let the telescopes converge and the angle of convergence is *A T B*, and presuming the telescope at *B* is pointing at right angles to the base line the angle of convergence is measured by the arc, *C E*. The bridge is out of balance, that is, the needle deflects, and the amount which it is out of balance will vary with the difference of position of the telescopes. The angles of convergence are not indicated upon the galvanometer, or reading instrument, but the deflection of the needle is marked in yards.

The speed indicator is, in reality, a small alternating-current dynamo, the current being great or small according to the speed of the shaft, and the strength of the current indicating upon an alternating-current galvanometer graduated in revolutions per minute. Six soft iron cores or inductors fastened to an iron ring on the shaft form the armature. These are rotated, the pole of a north and south magnet having two coils of wire at its extremities, the coils of wire being connected in series with the galvanometer.

The direction indicator simply tells in which direction the shaft is turning. A permanent magnet fastened to a ring on the shaft revolves in front of a soft iron bar, around which is a coil of wire that is connected to a galvanometer. The shaft revolving in one direction throws the pointer to one side, and when its direction is reversed throws it to the other side.

The Siemens & Halske System of Underground Conduits for Electric Roads.*

BY GUSTAV BRAUN.

The first successful electric road with underground conduits was built by the Siemens & Halske Company, in Budapest. As early as 1886 this company made exhaustive experiments with underground conduits on the grounds around its works in Vienna, which led to the construction of an experimental road 2.52 kilometres long in Budapest in 1887. Here all the technical problems, under the existing local circumstances necessary for a perfectly safe operation of the underground conduit system, were carefully worked out, and such favorable results were obtained that the Siemens & Halske Company could at once start with the construction of the first electric line with underground conduits.

This first electric road with underground conduits, which, as may be here remarked, was the first electric street railway in any large city in Europe, was thrown open to the public on July 30, 1889, and was soon followed by three other lines with underground conduits in the same city. These, together with the Quai line, which was opened in 1897, are the property of the Budapest Electric Street Railroad Company, and have a track length of 30 kilometres.

In the "Budapest system," a name by which this underground-conduit plant, as it was first applied in Budapest, soon became generally known, there is a concrete conduit under one rail containing two angle-iron conducting rails, one at each side of the conduit and fastened to the yokes by means of insulators. The yokes are placed at a distance of 1.2 m., and support and maihtain at the proper distance from each other the two halves of the tram rail which serves also as a slot rail.

The conduit presents in section an egg-shaped profile 0.28 m. wide and 0.33 m. high. At the top it is provided with a slot 33 mm. wide. From this it is obvious that the underground-conduit system in Budapest is distinguished from the American railways principally by the location of the slot, which is not midway between the rails—as is the case with cable roads—but coincides with the groove of one of the rails.

The two slot rails are subject to the same wear, since the flange of the carwheels is in the middle of the tire, an arrangement which, to my knowledge, is found nowhere else in Europe, but in Budapest it has proved very satisfactory.

The device for picking up the current employed in this system consists of two cast iron shoes, which are pressed outward laterally into the angle of the conducting rails by leaf springs and are attached to a thin plow passing through the slot and fastened to the truck of the car. Insulated cables through the plow conduct the current from the sliding shoes to the car controllers.

By the arrangement of two current-conducting rails, both insulated from the ground, a ground connection on both sides is necessary to cause a short circuit and all danger of electrolysis from stray return currents is eliminated.

The experience gained by the Siemens & Halske Company in Budapest in the course of several years was used to advantage in building the electric street railway in Berlin from Behren Street to Treptow in 1896, and in enlarging and improving the system of the Budapest Electric Street Railway Company in the years 1895-97.

These roads were constructed for through service with underground conduits and overhead trolleys. The conduit system was employed in Berlin for a track length of 4.5 kilometres, and in Budapest for 30 kilometres. The problem to be solved was to fit each car for use on both the conduit and the trolley systems, and in such a way that the change from the conduit system to the trolley system, and vice versa, should be effected with the least possible delay. For this purpose each motor car had to be provided with a trolley which could be easily pulled down, and with a contact plow which could be quickly removed from, or inserted into, the conduit. This problem was successfully solved by the Siemens & Halske Company, and at the same time other valuable improvements were made so that this system worked very successfully in Budapest, as well as in Berlin, notwithstanding the exceedingly large masses of snow during the winter of 1896-97, when, from time to time, all other means of traffic could not be kept in regular service in the streets of this large city.

The accompanying figures show the arrangement of this system as it is applied in Berlin. It differs but slightly from the similar

*Abstracted from the "Elektrotechnische Zeitschrift."

system employed in the Budapest roads in the design of the sliding contacts of the underground plow. In this, as in the older system described above, one rail of the track, the common grooved girder rail, is placed on concrete or gravel in the usual manner. The other track rail is supported by the cast iron yokes 1.25 metres apart and consists of two like rails of peculiar section, having between them a slot 30 mm. wide, in which run the wheel flanges and the plow.

The fastening of the rails on the yokes is effected by wrought-iron bracket-joints, which press down the foot of the rail and secure its web by means of two screw bolts. In order to prevent a contraction of the slot by the slipping of the slot rails a projection is cast on the support against which rests the foot of the rail.

The yokes stand on a foundation of broken stone and serve as ribs for the conduit which, otherwise, is made of concrete. For drainage sump pits are provided at intervals of about 50 metres, and empty into the sewer system. The clearing of the shafts is easily effected by flat shifters having about the same shape as the profile of them.

The placing of the conduit on the same side of the two tracks greatly simplifies the construction at switches, since it is not necessary to switch the conduit across from one track rail to the other or to use two plows on the car.

In comparison with American roads, in which, probably for local reasons, the underground conduit is located in the centre of the track, the Budapest system presents the advantage that, first, iron covers for the hand holes are not needed, and consequently less iron is required on the surface of the street, and, second, there are only two rails in the street, as with a common railroad track.

The current-conveying rails of this system are somewhat different from the angle-iron rails employed in the first Budapest installation. They consist of T-shaped rails of 1000 sq. mm. cross section and 10 metres long. These rails are placed with their heads toward each other, and are bonded at their joints. They are about 0.12 metre apart, and are perfectly sheltered under the rails of the track, so that it is impossible to see them from above through the slot, or to touch them. Further, they are located at a height of 0.24 metre above the bottom of the channel, so that water which might occasionally collect in the channel can flow off below them. They are hung by means of insulators at intervals of from 2.5 to 4 metres from the flanges of the slot rails, the insulators being inserted between two yokes. The arrangement of these insulators is illustrated in the figures.

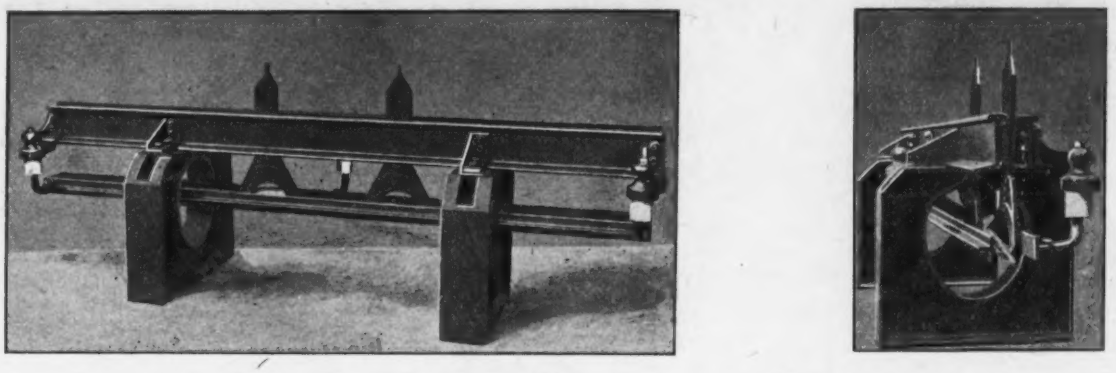


FIG. 1.—TWO VIEWS OF THE METAL PARTS OF THE CONDUIT.

The horizontal flange of the current-conveying rail is fastened by a vertical pin in a fork, mounted on a bolt fastened in the insulator. The latter is supported in a shell which is fastened to the flange of the rail in such a manner that the insulator is offset from below the slot and out of the way of dripping water.

Each insulator is placed in a special recess in the walls of the conduit and is surrounded by a cast-iron box cemented into the wall. A cover, easy to remove, permits of ready inspection from above, and by removing the pin in the conducting rail by means of a special tool and unscrewing the shell from the track rail, an exchange of the insulator is easily accomplished.

In order to be able to renew the current-conveying rail, should this be necessary, it is arranged that the slot rail on the side toward the track centre can be removed at certain places, especially on curves.

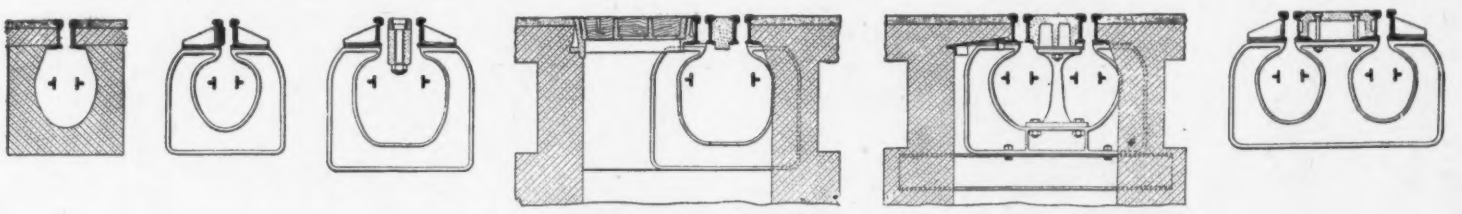


FIG. 3.—SECTIONS OF SWITCH SHOWN IN FIG. 2.

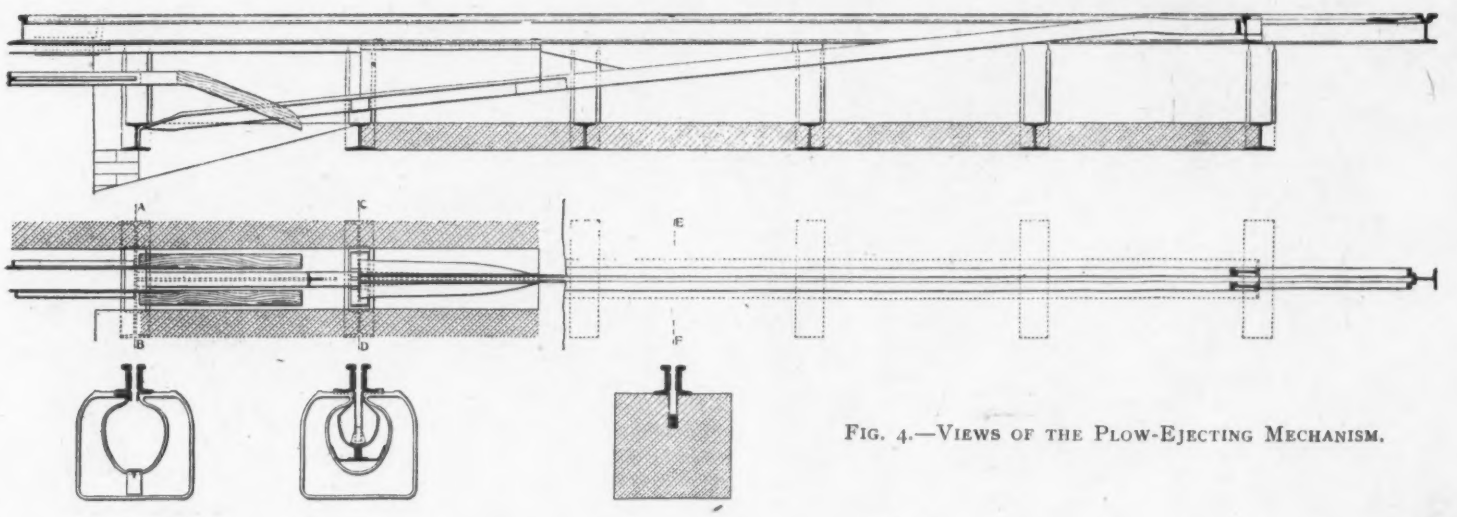


FIG. 4.—VIEWS OF THE PLOW-EJECTING MECHANISM.

The construction of the switches employed with the underground conduits is a difficult one, as it is necessary to provide a long nar-

row support or gusset plate for the tongue of the switch, since both conduits must retain their full sectional profile. This gusset plate consists of a strong iron casting, unsupported for a length of 1.8 metres, and carrying the movable switch tongue on its narrow end.

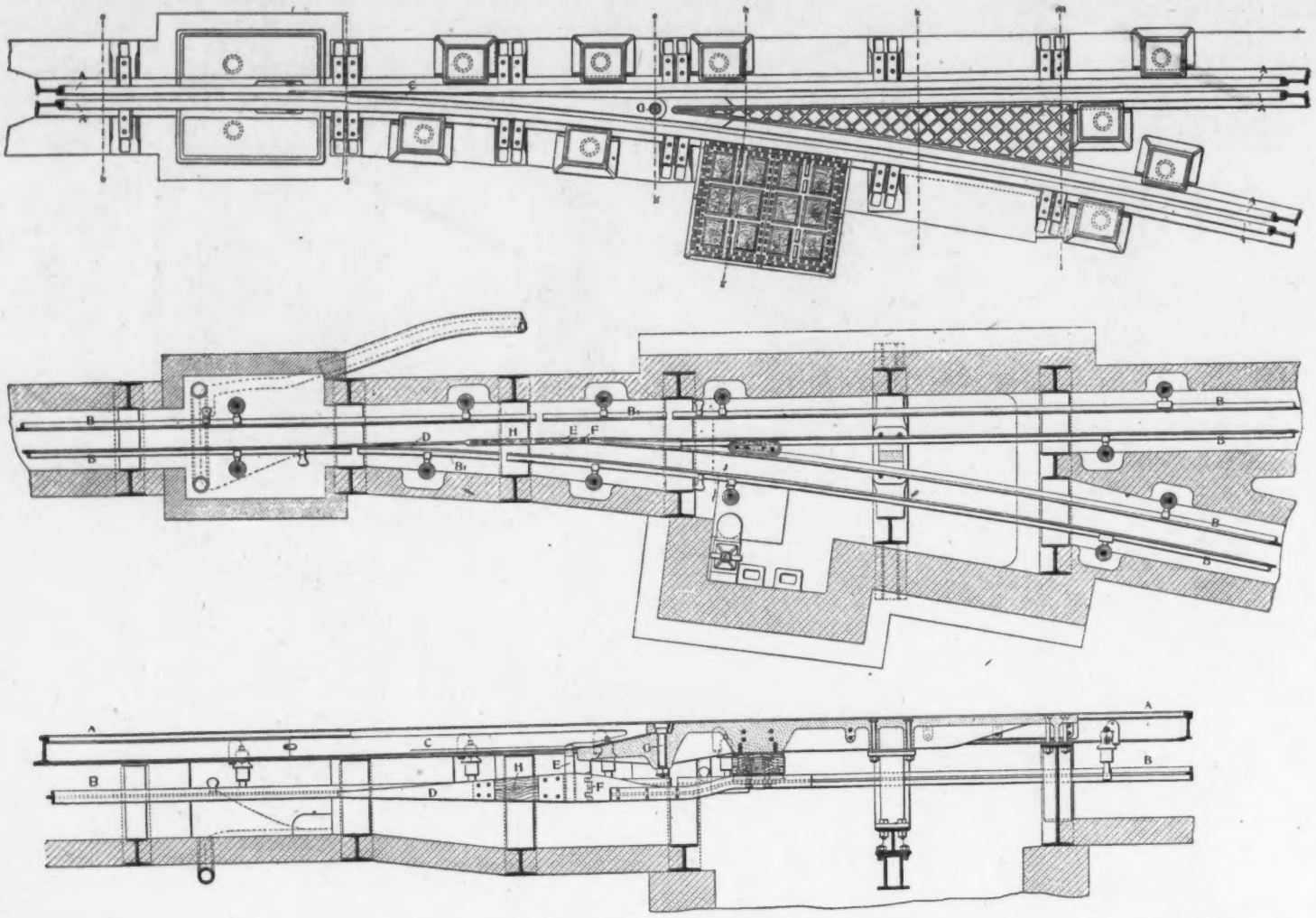


Fig. 2.—Plan and Sections of a Conduit Switch.

This tongue is so arranged that its point enters a recess in the track rail, giving it thus a support at both ends.

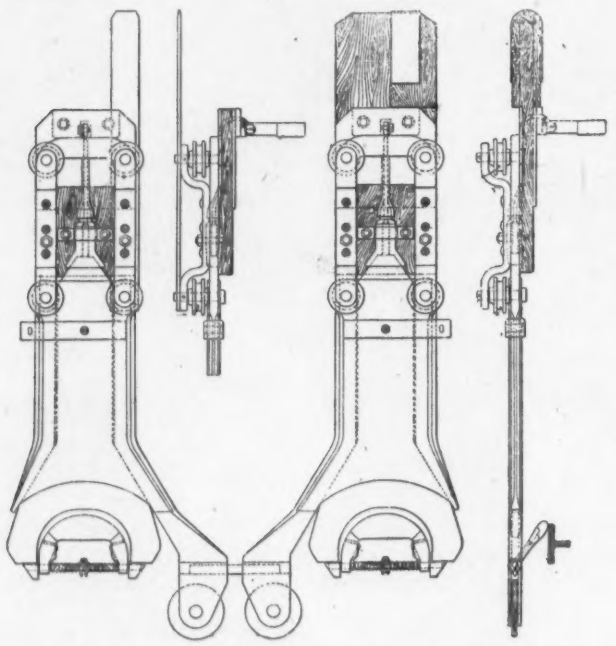


Fig. 5.—Elevations of the Plow.

The arrangement of the electrical switch is protected by patent and is shown in Figs. 2 and 3.

A represents the track rails; *B*, the current conveying rails; *C*, the switch tongue of the track rails, turning about pivot, *G*; *D* is the switch tongue of the current-conveying rail, having a turning point, *F*; and *E* is an insulated connecting rod between *C* and *D*. The switch tongue, *D*, consists of a pointed flexible front portion, connected to the rear part by an insulating piece, *H*. The parts are so arranged that the conductor-rail switch swings through a greater arc than the other, as it should to reach its positions. This secures a smooth passage of the plow contacts and reduces the portion of the rail which is without current to a minimum, corresponding to the length of the insulating piece, *H*. The length of the insulated sections, B_1, inserted in the current-conveying rails is made

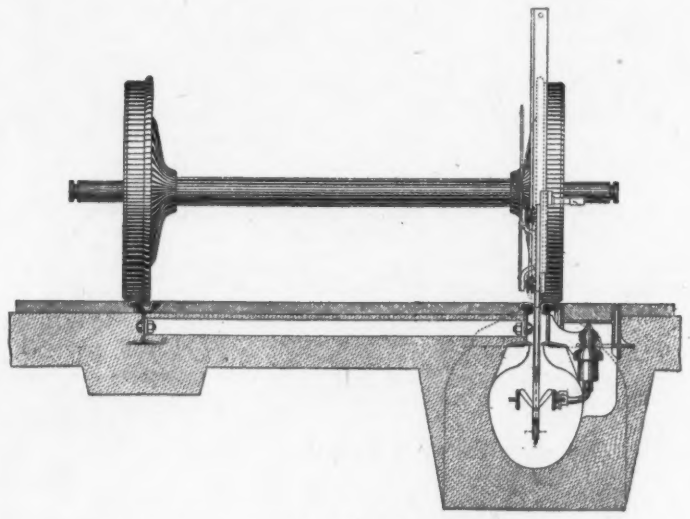


Fig. 6.—Cross-Section of Conduit, Showing Plow.

greater than that of the insulating piece, *H*; so that arcs occurring when a car passes over the switch are always formed on the current-conveying rails, *B*.

The plow consists of a frame which is secured to the car in such a manner that it is capable of swinging freely in a horizontal direction, so that the contacts attached to it will easily follow when the car passes curves and switches.

As shown in the illustration each part of the double device consists essentially of a wrought-iron casing, in which is fastened a well insulated iron plate carrying pivoted on its lower end a metal leaf which rests against the current-conveying rail.

The contact leaf is rotated outwardly toward the rail by helical springs coiled on its pivot. These springs permit the leaf to be folded up or down into a vertical plane coincident with the plow. This makes it possible to introduce or remove the device through the slot, the leaves being sprung out against the two conducting rails respectively, as soon as they are clear of the slot. When the plow is raised its connection is also broken from the car circuits.

The plow carries four small wheels engaging with vertical T-iron guides fastened to the truck of the car. The raising or lowering of the plow may be effected by the motorman by means of a chain.

In order to effect a quick and safe change from the underground-conduit system to the overhead trolley, and vice versa, the company has at the proper points built an inclined conduit floor which effects the automatic insertion and removal of the plow and the proper change of connections.

As shown in the figures this is effected by providing in the conduit an inclined and gradually narrowing terminal which pushes the plow up and simultaneously folds the contacts in so that they may pass through the slot. From the surfaces of the rail up to a point 5 cm. higher the device has naturally to be raised by hand by the motorman.

In entering the conduit tract the action of the arrangement is reversed. The motorman releases a catch on a ratchet wheel which is mounted upon the drum holding the chain to the plow, and the latter slides, by virtue of its own weight, down the inclined plane through the slot and into the conduit.

This conduit system has proved to be a perfect success in every respect, and has worked well under the severest trials. For instance, in 1896 there were made in Budapest, on the lines operated by underground conduits, nearly four millions car kilometres, and about thirty millions of passengers were transported.

Because of the good results obtained in Budapest and Berlin with underground conduits, the system is now being introduced in other cities, such as Brussels and Paris. In Germany another line has been built by the Siemens & Halske Company, this system having a ground return so that but one conductor rail is necessary in the conduit. It is especially noticeable that the conduits are completely interrupted in this system at crossings and switches; while passing such places the plows are automatically lifted out of the channel and inserted again by means of an inclined plane.

An Opportunity for Engineers Experienced in Underground Work.

The "Cosmopolitan Magazine" offers a prize of $250 for the best essay on the arrangement and construction of subways for carrying the various pipes, tubes and conduits under the streets of large cities. Although it is not so stated definitely, the wording of the offer indicates that plans for a tunnel in which the services can be installed and repaired without disturbing the surface of the street are wanted in the competition.

Little Leaks.

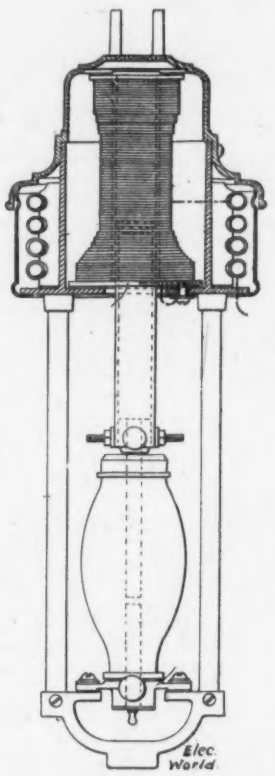
The surprisingly large aggregate to which apparently trivial but continuous leaks may amount is shown in a paper recently read by the chief of the Philadelphia Weather Bureau, in which it was stated that a leak of one drop per second amounts to five gallons per day. Central stations with leaky piping, paying for water by meter, may well remember this and also that apparently trivial steam leaks are a loss not only of water but of coal, and electrical leaks, of water, coal and labor.

Electric Power on the New Monitors.

The four new monitors for which bids were opened on October 1 will be quite fully equipped with auxiliary electrical apparatus, electric motors being installed for the turret-turning gear, ammunition hoists and ventilating apparatus.

An Arc Light Regulator Without a Clutch.

United States patent No. 611,601, issued October 4, 1898, to Mr. S. Bergmann, of the General Incandescent Arc Light Company, of New York, describes an arc light controlling mechanism, so simple in character that it seems as though the maximum obtainable reduction of parts was about obtained. As may be seen from the accompanying illustration, the armature or plunger of the controlling solenoid—which is in series with the arc—travels through the full range of carbon consumption, the plunger being rigidly attached to the carbon. To obtain a uniform vertical lift—equal to the weight of the holder and upper carbon—through the entire travel of the plunger, the solenoid is wound with an increasing number of layers toward its upper, and particularly toward its lower, end. As is well known, the pull of a uniformly wound solenoid on a core equal to or greater than the solenoid in length is a maximum when one end of the core is about in a mid-position within the solenoid. By increasing the number of turns toward the ends of the solenoid, the pull of the end of the core near either end of the coil is increased, and a practical uniformity of pull obtained over a considerable travel. As noted in the patent, a similar effect can be obtained by winding the solenoid with a uniform number of layers throughout its length and varying the cross section of the core, or the two methods may be combined. In the lamp described the upper end of the hollow spool on which the core is wound is sealed and the core, fitting tightly within the spool, acts as the plunger



of its own dashpot. The spool is of metal, and the tightly fitting core also serves as a contact for the current. The series resistance is wound in a helical coil wrapped in an annular chamber around the controlling solenoid. The claims of the patent cover only the arrangement of this series resistance.

Electric Lighting Plant on a Sailing Vessel.

A sailing ship now being built at Camden, Me., is to be fitted with an isolated electric lighting plant. This ship is said to be the largest schooner ever built. She will be 282 feet long and will have a capacity of 4000 tons. She is intended to engage in the coal trade between Philadelphia and New England.

The Italian Electro-Technical Association.

The first number of the first volume of the annals of the Associazione Elettrotecnica Italiana, covering the papers and proceedings of this society from its founding in August, 1896, until April, 1898, has been issued. The volume has many valuable papers and indicates a lively interest in the welfare of the society on the part of the ablest electrical engineers in Italy.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE
AMERICAN AND FOREIGN
By Carl Hering

Dynamos, Motors and Transformers.

THEORY OF THE ROTARY TRANSFORMER. Kapp. "Elek. Zeit.," Sept. 15 and 22.—The first parts of a long article. After referring briefly to the various possible methods of converting an alternating into a direct current by means of revolving machines, as distinguished from rectifiers, and their relative advantages, he discusses the properties of the rotary transformer (Gr. "Uniformer"), which has but a single armature winding in which the alternating current is transformed into a direct current. In such a machine the relation between the alternating and the continuous voltage can no longer be chosen, as it is given by the conditions; this he discusses theoretically and obtains the following results, which give the relation between the e. m. f. of the alternating current and that of the continuous current in percentage of the latter; when the width of the poles is two-thirds of the distance between the centres of the poles these values are as follows: For single-phase, 75 per cent.; two-phase, 75; three-phase, 65; four phase, 53; six-phase, 37; when the widths of the poles is one-half the distance between their centres, these figures are 82, 82, 71, 58 and 42, respectively; for the three, four and six-phase systems the triangle or delta system is assumed. These relations will be changed only slightly when it is loaded, as the armature reaction is very slight; the alternating voltage is therefore in all cases smaller than the continuous, and in most cases a static transformer will have to be used to lower the line voltage. He discusses whether it is better to use a motor generator—that is, a motor coupled to a dynamo—or to use a rotary transformer. He discusses the question of the material required and the efficiency; the amount of material required for the motor generator is practically the same as that for two machines, but the speed may be relatively high; the combined efficiency will average 85 per cent.; its efficiency would be about 92.5 per cent.; that of the static transformer being 97.5 per cent., the total will be about 90, which is better than for the motor generator. The question of the material required is then discussed at length; for equal phases and single-phase currents the armature will be somewhat larger, but with two and three-phase currents appreciably smaller than in the usual continuous current armature for the same load; with phase-shifting the armature becomes larger than for phase equality; in general for two or three-phase currents the material and cost will be less than that of the continuous-current machine in the motor generator combination; the static transformer will be somewhat cheaper than the alternating-current motor; the cost of the rotary transformer and its static transformer will therefore be less; this supposes that one is not limited in the choice of the frequency, for otherwise this relation can be reversed, for with low frequencies the transformer, and with high frequencies the rotary transformer, becomes expensive; there may even be an impossible case when the number of poles is great and the number of conductors small. The output of a continuous-current machine is limited by the armature reaction rather than the heating, while with a rotary transformer the armature reaction is small and the limit is therefore determined by the heating; this he then discusses at length, assuming that the same armature is first driven mechanically and then by means of an alternating current, delivering the same continuous current in each case; he assumes that the currents have the sine form. He discusses first the single-phase transformer with phase equality, and obtains a simple formula; for equal heating a machine in which the width of pole is two-thirds of the distance between the centres of the poles will, when used as a rotary transformer, yield 12 per cent. less than when used as a simple, continuous-current generator; when the pole width is half the pole distance the output is 5 per cent. less, assuming in both cases phase equality; when there is phase shifting between the current and the voltage it will be less favorable. In the same way he discusses the case of single-phase currents with phase shifting, and gives a table of results for various angles; these show that the practical machine in every case has a greater output than the theoretical, whose field follows exactly the sine law; it is therefore useless, and even a disadvantage, to endeavor to produce the sine curves, as, for instance, by changing the form of the poles. The article is to be concluded.

ALTERNATING-CURRENT MOTORS WITH LARGE STARTING TORQUE. Deri. "Elek. Zeit.," Sept. 15.—A reprint of the article abstracted in the "Digest" July 9.

Lights and Lighting.

DROP OF POTENTIAL IN ARC. Mrs. Ayrton. Lond. "Elec.," Sept. 23.—A long abstract of her Brit. Assn. paper on the drop of potential at the carbons of the electric arc. The paper describes and gives the results of and deductions from her experimental researches. The carbons were solid, and the fall of potential between each carbon and the arc was measured by means of a third carbon from a half to 2 mm in diameter, which was introduced into the arc and connected with a galvanometer; the voltage between it and the main carbon was observed just before it touched the main carbon. The experiments were made with numerous lengths of arcs varying from 1 to 7 mm, and with currents from 4 to 14 amperes. The drop of potential at the positive carbon is affected both by the length of the arc and by the current, and is given by the following formula:

$$V = 31.28 + \frac{9 + 3.1\,l}{A}$$

The drop between the arc and the negative carbon is affected by the current only, and not by the length of the arc; it is given by the following formula:

$$V = 7.6 + \frac{13.6}{A}$$

The drop of the negative carbon is therefore by no means insignificant, nor does its sign change; its value is about one-quarter of that at the positive carbon. From these equations the value of the whole fall from carbon to carbon, less that in the arc, is as follows:

$$V = 38.88 + \frac{22.6 + 3.1\,l}{A}$$

She gives the equation found from her former tests for the whole drop, including the arc, and this contains exactly the same constant —38.88—thus showing that this constant does not belong to the positive carbon alone, but to both the positive and negative. Observed and calculated values agree quite closely. The three straight line laws which were found may be expressed as follows: If W represents the watts expended in either of the carbons, and a, b, c, d, e and f be constants, then for the positive carbon: $W = a + b\,A$ with the constant length of arc; or $W = c + d\,l$ with constant current; for the negative carbon $W = e + f\,A$. Others who have experimented with this third carbon placed it in the arc, but this cannot give very accurate results; she approached it to the main carbon and measured the last voltage registered by the voltmeter before it fell to zero. The importance of insulating the exploring carbon is apparent, and she hopes soon to solve that difficult problem.

TESTING ARC LIGHT CIRCUITS. Stevens. "Elec. Eng.," Oct. 6.—A note indorsing the voltmeter method suggested by Markland (see "Digest" Sept. 27 and Oct. 8), which he has used for some time past, and calling attention to a practical form of instrument based on this method, which is now in the market. In using this no complicated calculations are required.

ECKMUEHL LIGHTHOUSE.—"West. Elec.," Sept. 24.—A translation in abstract of the article noticed in the "Digest" Sept. 24.

Power.

ELECTRIC TRANSMISSION OF POWER. A. Siemens. Lond. "Elec. Rev." and "Elec. Eng.," Sept. 16, and "Elec.," Sept. 23.—A reprint of his Brit. Assn. paper. The first part is general in character, and discusses the development; in this he favors continuous as distinguished from alternating currents. The latter part gives a detailed account of the operating costs of the continuous-current plant at the Siemens factory, in which currents at 2000 volts are used; this has been in operation for six years, and has shown itself to be perfectly reliable, the expected great saving in cost having been fully realized. The costs are analyzed, and it was found that during last year the total cost of motive power was 4 cents per hp hour or 3.42 per brake hp per hour exerted by the motors; in this analysis he shows that, roughly speaking, the standing charges account for half the expense, fuel for a quarter, labor for an eighth, repairs for a twentieth and stores for the rest; the distance of transmission is relatively short, and if it were greater the standing charges would be still greater. He also shows the importance of increasing the load factor, and concludes that if electric transmission is used it is necessary above all things to use the power as constantly as possible; if power is wanted only at intervals and at short periods, no economy can be effected by electrical transmission. Owing to the good efficiency of an electric motor at different loads it will in most cases be best to group machines together and drive them from one motor; the most useful field for electric motors is to drive movable machinery and drilling tools. He advocates erecting the generating plant near a coal mine and distributing the power; such an installation was erected at Brakpan, in the Transvaal, a brief description of which he gives; three-phase currents are delivered at 750 volts, which is raised to 10,000; the total power is 4000 horse-power. There is a similar plant near Waldenburg, in Silesia, which has been at work for two years; the total power is 1200 horse-power, half of which is distributed as three-phase currents, which, for great distances, are transformed up to 10,000 volts.

THREE-PHASE POWER-DISTRIBUTION PLANT. Geipel. Lond. "Elec. Rev." and "Elec. Eng.," Sept. 16.—A reprint of his Brit. Assn. paper on electric power and its application on the

three-phase system to a carriage works. He assumes that 15,000,000 tons of coal are consumed annually in Great Britain for stationary engines, and he endeavors to localize the causes of the waste involved in connection with workshops and factories, and to show how this may be obviated by using electricity; he also endeavors to show how the maximum output of machine tools can be obtained, as also the greatest economy in labor. The well-known advantages of electric motors are discussed, after which follows a description of a plant in which electric driving superseded steam driving; the results of tests are given, an analysis showing a saving of approximately $5000 per year, besides other advantages. The reasons for adopting the three-phase system are given—namely, the absence of commutators, the better mechanical design and construction, the fact that such motors can run for long periods without attention, and the freedom from possibility of breakdown.

ELECTRIC MOTORS FOR SMALL INDUSTRIES. Gibbings. Lond. "Elec. Rev." and "Elec. Eng.," Sept. 16; reprinted in "El'ty" (N. Y.), Sept. 28.—A reprint of his Brit. Assn. paper on the application of the electric motor to small industrial purposes and its effects on trade and the community generally. He considers more especially the reasons why its application has been confined to a few special trades; (the paper has special reference to the conditions in England). He endeavors to show how large a sphere of influence the motor is destined to fill. He recommends as a solution of the problem that the central station should purchase good motors and hire them out, so as to diminish the cost to the small consumer; he shows the effect of this system in Bradford, where it has been in use for some time.

ELECTRICAL TRANSMISSION IN A JAPANESE IRON WORKS.—Lond. "Elec.," Sept. 16.—A note from the "Elek. Anz.," stating that in the iron and steel works in Yawatamura belonging to the Government electric power is used to drive the individual machines; the aggregate capacity is 1750 horse-power; current is supplied at 250 volts to several hundred motors, some of them of 100 horse-power.

MOTORS IN A TANNERY.—Lond. "Elec. Rev.," Sept. 11.—A brief, illustrated description of a new application in Cork in which electric motors are used to agitate the leather which is suspended in the tanning liquor; this agitation must be continued periodically, and in the present case it is accomplished by a collector, which switches the motor on and off at the desired intervals, the current being obtained from accumulators. The electric current is not used to accelerate the tanning process itself, as it is claimed to have been found that the resulting product is different from leather tanned in the usual way.

MINE DRAINAGE. Marten and Howl. Lond. "Elec. Eng.," Sept. 23.—A reprint of a short paper describing the scheme used at the South Staffordshire mines, in which electrically driven pumps are installed in the neighborhood of the mine to prevent the water from draining into the deep portion.

ELECTRICAL REFRIGERATION. Fay. "Elec. Eng.," Oct. 6.—The first part of an article describing his system, with the aid of illustrations. An electric motor operates, through double reduction gearing, two compressor pumps; the whole machinery, including the motors, is inclosed in an air-tight box, which is filled with the gas to be compressed; this is done in order to avoid the use of stuffing boxes, which consume much energy. Sulphur di-oxide is used as the gas to be compressed, as he claims this to have advantages over ammonia. The machine has been running for one summer, and the results of tests are given. The average horse-power of current was 3.08, while the power applied to the refrigerant was about 2 horse-power; this, in twenty-four hours, produced the equivalent of 2 tons of ice—that is, 1 ton is equivalent to 1 horse-power in twenty-four hours, delivered to the gas; water is supplied to lead off the heat.

DUMB WAITERS.—"Elec. Eng.," Oct. 6.—An illustrated description of those in the Chicago public library, which are operated by electric motors. Some move only in a vertical direction, while others move around angles. There are pointers on each floor, which are moved by hand, and if the elevator is not in use it will travel to that particular floor. The wiring is described, and the motors are illustrated.

POSSIBLE POWER FOR TRAMWAYS. Booth. "El'ty," Oct. 5; reprinted from the London "Railway World."—He calls attention to the power in the waste gases from blast furnaces, and advocates the use of this power for neighboring electric railways. Some figures are given concerning a blast furnace plant in Glasgow, of which he made tests. Other articles on the same subject by the same author have already been referred to in the "Digest."

POWER FOR WOOD-WORKING MACHINERY.—"West. Elec.," Sept. 24.—Results of some tests made by Dodge at the Navy Yard in Washington, in which he measured the power required by saws and drills under various conditions and at various speeds.

LANCEY.—"West Elec.," Oct. 1.—A translation in abstract, with some of the illustrations, of the description of this plant in the valley of Gresivaudan, which was noticed in the "Digest" last week.

SUBMARINE BOAT.—"Elec. Eng.," Sept. 29.—A translation in abstract, with illustrations of the Sandor Bak boat noticed in the "Digest" last week.

ELEVATOR DOOR OPENERS.—"Elec. Eng.," Sept. 29.—An illustrated description of a device in which the sliding doors are moved by means of a double solenoid acting on a lever above the door, the circuit being closed by a push button on the elevator.

Traction.

ELECTROLYTIC CORROSION BY RETURN CURRENTS. Fleming. Lond. "Elec.," "Elec. Rev." and "Elec. Eng.," Sept. 16; a reprint is begun in "El'ty" (N. Y.), Oct. 5.—A reprint in full of his Brit. Assn. paper on the electrolytic corrosion of water and gas pipes by return currents from electric tramways. One of the Board of Trade rules states in effect that if the pipe is negative to the rail the voltage shall not exceed 4.5 between them, and if the pipe is positive to the rail the voltage shall not exceed 1.5; this rule he shows does not afford protection. Electrolytic corrosion can ensue only under two conditions; the voltage must create a current which leaves the pipe, and the conduction throughout the surrounding soil, or at least into it, must be electrolytic in character; the danger areas are those in which the pipes are positive to the rails, and where the current flows out of the pipes into adjacent electrolyzable soil. He proceeds to discuss whether there can be any danger if this Board of Trade rule is obeyed. He describes experiments made with London clay and other soils, in order to measure the conductivity; he found that there was electrolytic conduction and that the resistance of the moist clay was nearly 17 ohms per yard cube; this is, however, greatly dependent on the state of the clay as regards moisture. A mass of damp sand moistened with salty water has an approximate resistance of 1 ohm per yard cube. Lindeck's measurements of cement blocks are briefly referred to; in the normal condition the resistance is about 50 ohms per yard cube, but this depended very greatly on the conditions of moisture. The conduction in all of these, being largely due to the presence of water, is in great part at least electrolytic in character; in the average condition of moisture he thinks the probable specific resistance of the average subsoils in towns will lie between 15 and 30 ohms per yard cube, which is of the order of 1000 million times that of copper, but although this is high, the actual total electrical resistance between extensive metallic surfaces may be numerically very small; between two 6-inch clean iron pipes, for instance, 100 yards long, placed in the ground 2 feet deep, the actual measured reesistance would in general be something like 1 ohm; a voltage of 1.5 may therefore cause the flow of very considerable quantities of electricity; moreover, a large portion, if not the whole, must be carried by electrolytic conduction, and if the current flows out of the pipe there will be electrolytic corrosion. One cubic inch of iron may be removed from the positive plate by the electrolytic passage out of it of between 127.7 and 182.5 ampere hours, depending on whether the metal is removed in a ferric or ferrous state; this quantity of electricity is, roughly speaking, 1 ampere week. He then discusses the question of the minimum voltage, which will produce electrolytic corrosion; if the surrounding soil favors electrolysis a far less difference of potential than the maximum of 1.5 volts permitted by the Board of Trade can produce rapid corrosion; he describes an experiment made to illustrate this; this also showed that the weight of iron removed may very much exceed the electrochemical equivalent, which is due, no doubt, to local action. In an experiment the loss was found to be nearly three times the theoretical amount. A practical experiment was tried in which three lines of iron pipe were buried parallel to each other in the soil; two adjacent rows were kept at 1 volt difference of potential night and day for six months, and daily readings were taken of both the voltage and the current; the third line of pipe was not connected, so as to observe the normal appearance of the pipes. When the pipes were dug up their appearance was very different; that which had been connected to the negative pole had a clean gray color, with scarcely a trace of oxidation; the one connected to the positive pole was uniformly covered with an orange yellow oxide; the neutral pipe was oxidized slightly in places, but not uniformly; 662 ampere hours had passed between two of the pipes; there was clear indication of electrolytic action; the difference between the two pipes amounted in effect to a greater rate of aging of the positive pipe. The question of the resistance of the joints is then discussed; if it were not for this resistance the conductivity would always be much greater than that of the soil which the pipe displaces; that of a 5-inch cast iron pipe would be about one-third of an ohm per mile, and with leaded joints the joint resistance may not be large; it is, however, probable that the network of pipes forms a system of conductors whose conductivity is greater than the soil displaced by it. He then considers the electric conditions in the neighborhood of an electric trolley line; he shows that if the ends of the pipes are at places where the potential is different, it is certain that a current must flow through them and no amount of conductivity in the soil, short of infinity, will altogether prevent this from happening; in the case of long lines it is unquestionable that the difference of potential in portions of the track involves as a certain consequence the flow of electricity through the earth, however sufficient the rail bonding may be. He then describes a small working model in which rails and pipes were imitated by conductors placed in the soil. In his final summary he draws the following conclusions, referring to street railways with uninsulated rails as return conductors: No amount of bonding of insulated rails will entirely prevent current through the adjacent earth; some portion of this current will pass through subterranean pipes, the amount depending on various conditions; a mere difference of potential between the pipe and the rail is not in itself a source of danger to the pipe, as there must also be electrolytic conduction out of the pipe through the soil, which must contain electrolyzable salts; if this electrolytic conduction exists there is no absolute surety in the Board of Trade limit of 1.5

volts, except that the less the voltage, the less the damage; a fraction of a volt will suffice to cause corrosion; the conditions most to be feared are when certain local soil conditions exist near the places where the pipe is most positive to the rail; for determining possible pipe corrosion an electrical survey should be made, showing the difference of potential between rails and pipes at various places. No reference is made to the question of a remedy, as he merely attempted to show that even when the Board of Trade regulations were carried out it must not be assumed that the danger does not exist.

SPEEDS ON STREET RAILWAYS. Geron. Lond. "Elec. Rev.," Sept. 16.—An abstract of a translation of his paper from the "Railway World." He made inquiries regarding the speeds found most suitable in various tramways and received replies from twenty-one companies operating steam, electric and other railways in the leading continental countries. He makes a distinction between suburban and urban roads. On the Italian tramways the maximum speeds vary from 16 to 20 km per hour (9.9 to 12.4 miles); these are reduced to from 6 to 12 km in the densely crowded streets. It is believed that the official maxima might well be raised to 24 to 30 km (18.6 miles), on an independent, permanent way. In Belgium the speeds are 7 and 10 km in populous districts, and 14 to 17 in other parts; outside of crowded districts it must not exceed 30 km; 18 to 20 are the limiting speeds in several other Italian cities, all of which join in the opinion that greater speeds might be used without additional danger and with additional profit. At Crefeld, Germany, the speeds are 12 to 20 in populous and outside districts. He thinks the Belgian companies' rules best conform to practical necessities.

LONDON CENTRAL UNDERGROUND RAILWAY. Tripier. "L'Eclairage Elec.," Sept. 17.—The continuation of the very long, profusely illustrated article on this railway, the first part of which was noticed in the "Digest" Sept. 17. Many details are illustrated and numerous diagrams are given.

AUTOMOBILES. Feldmann. "Elek. Zeit.," Sept. 15.—A long, well-illustrated translation in abstract of the long report of Hospitalier, which was noticed in the "Digest" last week.

ELECTRIC AERIAL RAILWAY.—"Elec. Eng.," Oct. 6.—A brief, illustrated description of the one which is now in course of construction between Elberfeld and Barmen. The Langon system is used; in this the car is suspended below the track. The line runs over a river all the way, and the track is supported by inclined girders resting on the banks. The line is 8 miles long; the cars will seat fifty to sixty persons; the speed is to be 25 miles per hour; the cost of the double-track road is "between two and five million" dollars (sic); it will be finished in about two years. The system is said to be perfectly safe.

SINGLE V. DOUBLE TRUCK CAR. Graham. "El'ty," Sept. 28.—An unfavorable criticism of the recent paper by McCulloch (see Electrical World Sept. 17). The present writer favors the single-truck car, citing a number of cases where it is used; he claims that McCulloch "did not know what he was talking about" and is not posted in the art.

EVAIN-LES-BAINS.—"Elec. Rev." and "El'ty," Sept. 28.—A brief description of this polyphase railroad plant (see "Digest" Sept. 17).

Installations, Systems and Appliances.

CHARGING FOR ELECTRIC ENERGY. Meynier. "L'Ind. Elec.," Sept. 10.—A short article suggesting a new method of charging which he considers rational. He argues that the most desirable consumer is the one who uses the greatest number of kilowatt hours per kilowatt installed; he therefore suggests a reduction which increases with the number of lamps installed and a second one proportional to the consumption per lamp; motors and other apparatus are represented by their equivalent in lamps; he refers particularly to the number of lamps, and not to the kilowatts, because the latter unit is not always understood by the consumer. The consumers will not be too economical in their use of current in order to get the second reduction.

BRISTOL. Proctor. Lond. "Elec. Rev." and "Elec. Eng.," Sept. 16.—A reprint of his Brit. Assn. paper describing the electric lighting system at Bristol, with special reference to the auxiliary plant. Alternating current is supplied to customers and continuous current is used for public lighting; there are one generator station and thirty-eight sub-stations. Tabulated data are given concerning the working of the various pumps.

FRANKFORT-o-M.—"Elek. Zeit.," Sept. 15.—Long extracts from the report of the operation of this alternating current station for the year ending March, 1898.

TRANSFORMERS IN PARALLEL.—Lond. "Elec. Eng.," Sept. 16.—Several answers to a request to show what connections to use in order to ascertain, without opening the circuits and with one ammeter, the distribution of the load between three transformers in parallel.

MUNICIPALITIES AS TRADERS. Pierson. Lond. "Elec. Rev." and "Elec. Eng.," Sept. 16.—A short Brit. Assn. paper, pointing out the advantages of municipal trading, which he advocates, citing Birmingham, Manchester and Glasgow as examples; few failures have been reported, which he thinks is due to the fact that there are few failures to report.

WATER-POWER PLANT. Coho. "Elec. Eng.," Sept. 29.—A brief, illustrated description of a 1000-light alternating-current plant at the St. Joseph Sanitarium in Sullivan County, which he constructed; it is driven by the water from a brook, having a 70-foot fall; a dam holds enough water to run the plant fifty-two days without rain.

SWITCHBOARDS.—"West Elec.," Sept. 24.—Some brief, illustrated hints concerning the construction of switchboards.

Wires, Wiring and Conduits.

COPPER, ALUMINUM AND IRON CONDUCTORS. Felten and Guilleaume. Lond. "Elec. Rev.," Sept. 16.—A communication referring to the recent article of Kershaw; they give the conclusions which they arrived at in a more practical way. The question must be limited to aerial conductors, as aluminum and iron could not be used for underground conductors, for which copper will continue to be the only practical material. It serves no practical purposes to compare the prices of the metals in the crude state, and the only comparison of value is that of the finished wire; as iron must be protected by a coat of zinc, and as the drawing increases its low value more in proportion than with copper or aluminum, the results of the comparison are necessarily different from those obtained by Kershaw. They start with the following values at which the wires can be bought at present; copper, 14 cents per pound; aluminum, 33 cents, and galvanized iron wire of 16.4 per cent. conductivity, 3.5, or of 12.5 per cent. conductivity, 1.8. Taking Kershaw's figures for specific gravity and conductivity, they obtain the following results: Ratio of copper to aluminum, 100 to 120; copper to iron of 16.4 per cent., 100 to 138; copper to iron of 12.5 per cent., 100 to 93. Commercially, therefore, aluminum is 20 per cent. dearer than copper; iron or 16.4 per cent., 38 per cent. dearer, and iron of 12.5 per cent., 7 per cent. cheaper. The low density and low tensile strength of aluminum are claimed to exclude it from overhead purposes; its strength may be increased by alloying with other metals, but this would reduce the conductivity and increase the specific gravity.

Electro-Physics and Magnetism.

FLUORESCENCE AND ROENTGEN RAYS. Arnold. "Mitt. Phys. Inst. Erlangen," March; abstracted briefly in the Lond. "Elec.," Sept. 16.—He investigated whether the fluorescence of the anti-cathode has a favorable or unfavorable influence on the production of these rays. The anti-cathode was made to consist of a fluorescent and non-fluorescent plate, and a pin-hole camera produced an image of the compound cathode on a sensitive plate. With none of the substances used could any difference produced by luminescence be observed? It appears, therefore, that there is no connection between Röntgen rays and luminescence.

ROENTGEN RAYS. Levy. "Elek. Zeit.," Sept. 22.—A reprint of a paper read before the Union of German Electricians, on progress in the technic of Röntgen rays. He first discusses the theory briefly, and then the construction and application of the apparatus as made by him. Regarding the theory, he states that in Germany the tendency is now to favor the theory originated by Crookes, according to which the cathode rays are negatively charged particles which are discharged at a high velocity from the cathode; their velocity has been calculated, but the results differ greatly; it is, however, likely that it is much less than the velocity of light. J. J. Thomson suggested that these exceedingly small particles are subdivisions of the atoms, and that the properties of these elementary particles are the same. When these particles strike the anti-cathode their velocity is suddenly checked, which produces ether waves of no particular period, which in their properties are analogous to the waves in air due to explosions; these ether waves having no particular period are the Röntgen rays, light rays being periodic. He then discusses and describes the apparatus as he constructs it, an illustration being given. Among the three methods of producing these rays—namely, with the Tesla transformers, the influence machine and the induction coil—he favors the latter, saying that the former is no longer used in Germany, as there are two centres of emission of the rays; to influence machines there are a number of objections, but if these could be overcome they would be a very cheap and good source of the rays.

LAW OF INDUCTION.—"Elek. Zeit.," Sept. 22.—The continuation and conclusion of the long discussion of Breslauer's paper (see "Digest" Aug. 20; Sept. 24 and Oct. 8), in which he endeavors to give a new and more general statement of the law of induction. Unfavorable discussions by Marburg, Westberg and Feldmann were noticed in the "Digest"; the present discussion contains a reply to these by Breslauer, in which he simply defends his original statement of the law, still claiming that it will cover all cases; the replies to his critics seem vague and unsatisfactory. This is followed by replies from each of the critics, in which they show that Breslauer's statement is not general, and in some cases leads to even wrong results; also that when applied to a reversal of the field, it is based on incorrect foundations; further illustrations, showing that it is unsatisfactory, are given; Feldmann suggests a critical experiment. The final reply from Breslauer is brief, and does not seem to meet the criticisms. He still maintains that the theory of cutting lines of force cannot be applied to cases in which there is magnetic screening. The result of the whole long discussion seems to be that the theory of the cutting of lines of force is adequate, covers all cases and is perfectly satisfactory, and that the new law of Breslauer is not.

MAGNETS AND TEMPERATURE. Ashworth. Lond. "Elec. Eng.," Sept. 16; reprinted in "El'ty" (N. Y.), Oct. 5.—A brief abstract of his Brit. Assn. paper on the construction of

magnets of constant intensity under changes of temperature. He describes experiments showing a remarkable property of drawn steel wires; magnets made with such wires, after a series of heatings and coolings, reached a state in which an increase of temperature produced an increase of magnetic moment and vice versa. In passing from this abnormal to the normal state a stage is reached at which a change of temperature neither increases nor decreases the magnetic moment, and for the ordinary atmospheric changes of temperature the intensity of such a magnet remains constant.

PERMEABILITY UNDER CROSS MAGNETIZING FORCES. Everett. Lond. "Elec. Rev.," Sept. 23.—A short article discussing this theoretically. He points out fundamental errors made in previous contributions on the subject. He shows that if a transverse force is applied to a magnetic circuit in which a longitudinal force is acting the effective longitudinal permeability will in general be altered in this portion, and hence also the total flux of longitudinal induction through every section of the circuit. An example of such a case is the counter-magnetization in the armature of a dynamo; this must slightly lessen the effective permeability of the iron in the armature and the lines due to the field.

TERRESTRIAL MAGNETISM. Ruecker. Lond. "Elec.," "Elec. Rev." and "Elec. Eng.," Sept. 16.—A long abstract of his presidential address to the international conference on terrestrial magnetism and atmospheric electricity. He pointed out the importance of international co-operation in the investigation of magnetic and meteorological phenomena; there is also urgent need for more perfect organization of a directing body which should decide what should and should not be done. He then considers the way in which such co-operation should be secured. In conclusion he refers to the serious menace to magnetic observatories of the rapid extension of electric railways.

TERRESTRIAL MAGNETISM. Cotterell. Lond. "Elec. Rev.," Sept. 16.—The conclusion of his article (see "Digest" Oct. 1). He endeavors to show the likelihood of his hypothesis that the earth is a recipient of an ethereal line of force, as distinguished from its being a huge magnet.

ANALOGIES BETWEEN METEOROLOGICAL AND MAGNETIC PHENOMENA. Van Rijckevorsel. Lond. "Elec. Eng.." Sept. 16.—A very brief abstract of his Brit. Assn. paper. He shows how exactly similar the yearly temperature curves are for a large part of Europe, and how the anomalies which these curves show may contribute to the discovery of their origin. He plotted six annual curves for temperature, air pressure, rainfall, magnetic declination, and vertical and horizontal components of the earth's force, and shows that all these curves, however dissimilar in their general direction, are exactly alike in their anomalies.

X-RAY WORK IN BALTIMORE. Fairchild. "Elec. Eng.," Oct. 6.—A brief account of the work done at several hospitals and a college in that city. At the latter, Tondorf has been experimenting on the blind, and although some remarkable results are claimed to have been obtained, they are said to be of little or no practical value.

Electro-Chemistry and Batteries.

ELECTRO-CHEMICAL SOCIETY. Muller. "L'Eclairage Elec.," Sept. 17.—The continuation of the abstracts of the papers read at the recent congress in Leipsic. Abstracts in German journals have already been referred to in the "Digest."

CALCIUM CARBIDE WORKS AT INGLETON. Matthews. "El'ty," Oct. 5.—A reprint of the article noticed in the "Digest" last week.

Units, Measurements and Instruments.

ELECTRIC TRACTION AND MAGNETIC OBSERVATORIES.—Lond. "Elec.," Sept. 16.—A long editorial referring chiefly to several recent papers in which protests were made against the interference of terrestrial magnetic observations caused by the proximity of electric railways to magnetic observatories; it refers more particularly to the discussion of this subject at the recent Brit. Assn. meeting. Ruecker stated that there was no desire to stop the spread of electric traction, but that the object of the inquiry was to discover some means by which electric traction might be extended without interfering with magnetic observations. At the Kew observatory provisions have been made which will affect the magnetic induction influences, as these are to be reduced to a negligible amount by keeping the return conductor within a certain distance from the feed and trolley conductors—that is, within the one-hundredth of the distance between the tramway and the observatory. The observatory authorities are apparently not alarmed at the possibility of disturbances from earth currents; for the latter he sees no remedy other than the complete insulation of the return conductor; S. P. Thompson claimed that all difficulties might be obviated by the simple expedient of abolishing continuous currents and using the three-phase current with insulated conductors. Editorially it is thought that the best protection would be the adoption of an insulating return conductor in such a position relatively to the supply conductor as will reduce the magnetic disturbance to a negligible quantity; this would apply chiefly to densely populated districts and not to rural districts.

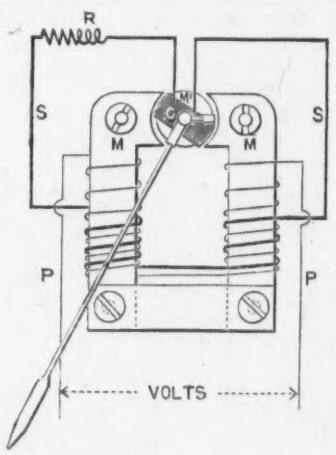
The Lond. "Elec. Eng.," Sept. 23, contains abstracts of the discussion of this subject at the recent Brit. Assn. meeting.—Schott (U. S.) exhibited curves showing the effect of electric railways on the records of magnetic observatories, the small alterations being entirely masked; there were also many abrupt changes, which rendered the record almost valueless. The observatories in Washington, Texas and Toronto have been rendered useless by electric railways; the vertical components suffered most; he considered that 4 miles was the shortest distance that should be allowed between an electric railway and an observatory. Ruecker described experiments made after the opening of the City & South London Railway; the vertical components suffered most; the question of distance alone, for preventing these disturbances, was not the best way of looking at the subject; in connection with the Kew observatory it is provided that the insulated returns in a neighboring tramway should be used to prevent earth currents; also that the two conductors should not at any point be farther apart than a hundredth of the distance of that point from the observatory; he had experimented with 500 amperes on two wires 30 feet long placed 1 km from the observatory, and had found that only the fifth place of decimals was affected. Eschenhagen gave his experience with measurements near Berlin; he found disturbing effects at a distance of 8 km; the earth currents were most to be feared; an uninsulated return conductor was the best preventive. Preece studied the disturbances on telegraph lines; the Metropolitan Railway, on which the experiments are soon to be made, will use a complete magnetic circuit. Ayrton advised the use of an insulated return.

DISSIPATION OF ENERGY IN CONDENSERS. Rosa and Smith. Lond. "Elec. Eng.," Sept. 16.—A brief abstract of their Brit. Assn. paper. They describe experiments in which they measured the heating effect of an alternating current on the dielectric of a condenser; they measured this with a wattmeter, using a coil of wire in series with the condenser to give resonance and raise the voltage. In a second series of experiments they placed the condensers in a calorimeter and measured the heat; the two results agree.

TEMPERATURE COEFFICIENT OF STANDARD COILS. Solomon. Lond. "Elec.," Sept. 23.—A reprint of his Brit. Assn. paper describing his determination of the temperature coefficient of the two 10-ohm standard resistance coils which were used by Ayrton and Jones in their determination of the ohm in 1897. The methods are described and the results given.

CABLE TESTING. Murphy. Lond. "Elec.," Sept. 23.—A short article giving some rules to facilitate the calculation of the influence of the "E. C." upon the results obtained by Schaefer's method of localizing breaks in submarine cables. The method is well spoken of editorially.

ALTERNATING CURRENT INSTRUMENT. Heap. Lond. "Elec. Rev.," Sept. 23.—There are two sources of error in alternating-current ampere and volt meters—namely, those due to changes in periodicity and in wave form; the instrument which he describes and which he has designed is claimed to overcome these sources of error, while at the same time there is considerable deflecting force; the temperature error is negligible, and the consumption but a few watts. The principle is shown in the adjoining diagram. The magnet is made of laminated iron; the armature core is stationary, and the small coil is movable. The iron frame is wound with two coils, one of which, the primary, is connected to the source of supply and forms the exciting current of the electromagnet; the other, the secondary, shown in thick lines, is short-circuited through a resistance and the movable coil; the coil will then be deflected through an angle, which varies with the volts supplied to the terminals of the primary; the calibration curve, which is shown, appears to be practically a straight line, except near the origin. In order that the readings may be free from the periodicity and wave form errors, the magnetic leakage should be small and should remain constant; the air gap is therefore made small and the secondary turns are wound around the lower part of the magnet. To show its freedom from these errors he gives the results of readings made with different currents. An amperemeter may be constructed on the same plan; the primary turns are then few in number, or may be connected to a small transformer through which the main current passes; the resistance R is replaced by inductance. The instrument can be made so as to have two or more ranges.



POTENTIOMETER.—Lond. "Elec. Eng.," Sept. 23.—Several descriptions of an easily constructed form of potentiometer for graduating small ammeters and voltmeters.

MEASURING TEMPERATURE FROM A DISTANCE.—"El'ty," Sept. 28.—A short description of an apparatus devised by

Whipple. A tube containing a german silver and a copper wire is introduced in the liquid or space in which the temperature is to be measured; they are connected as two arms of a Wheatstone bridge at the receiving end, and a telephone is used in place of the galvanometer; a pointer is moved over a dial by hand and points to the temperatures; this pointer is moved until no sound is heard in the telephone; it adjusts the other two arms of the bridge until the balance is reached. It is used in the State House in Boston for measuring the temperature of the rooms, by the engineer in the basement who is in charge of the heating. A further application is suggested in connection with cold storage warehouses; also to the measurement of temperature in high altitudes by means of kites or balloons.

Telegraphy, Telephony and Signals.

TELEPHONE STATISTICS.—"Elek. Zeit., Sept. 15; abstracted from the "Jour. Télégraphique."—A table of statistics for the year 1896 for the European countries and a number of countries in Asia, Africa and Australia. The table contains the usual data given in connection with telephone statistics; Great Britain is not included. Among the countries named Germany heads the list with 587 telephone installations, followed by France with 482. In the number of interurban lines Germany heads the list with 2001, involving 35,496 km of wire; this is followed by France with 637 and 50,008 km; then Sweden, with 611 and 28,667. The number of central stations in the two former countries is slightly greater than the number of installations; Sweden heads the list in the number of central stations, which is 633 belonging to the Government, 199 private and 188 on the co-operative system.

PACIFIC CABLE. Bright. Lond. "Elec. Rev." Sept. 23.—A reprint of his Brit. Assn. paper, in which he shows that there are no engineering or electrical difficulties standing in the way of laying an all British cable. He calls attention to the inactivity on the part of England. He discusses the matter under the different heads—namely, type of cable, the laying, repairing and electrical working, pointing out that there are no impossibilities involved. Cables have been laid and repaired in depths of over 3000 fathoms; the greatest depth in the route from British Columbia via Australasia is 3400 fathoms near the Fiji Islands. The alternative—namely, a cable from England to the Cape and to Australia via Gibraltar—is also discussed.

BRITISH TELEGRAPH DEPARTMENT.—Lond. "Elec.," Sept. 16 and 23.—Editorial criticisms of the Postmaster-General's annual report. Particular attention was called to the large deficit, which is far greater than for any previous year; although the growth of the telegraph traffic increased, notwithstanding the effect of the telephone service, the deficit nevertheless increases more rapidly. There is a 3-mile free delivery at all hours throughout the whole of the area of the metropolis, and some messages are therefore delivered at a great loss. Some figures from the report are also given in another part of the issue. Some extracts of the report are also given in the Lond. "Elec. Rev.," Sept. 16.

SYNCHRONISM IN WIRELESS TELEGRAPHY. Tietz. Lond. "Elec. Rev.," Sept. 16.—A translation in abstract of the article noticed in the "Digest" Sept. 10 (see also Oct. 1).

TELEGRAPHY BY ULTRA VIOLET LIGHT. Zickler. Lond. "Elec.," Sept. 23.—A translation in abstract of the article which was abstracted in the "Digest" Aug. 13.

COMMON BATTERY TELEPHONE CIRCUIT.—"Elec. Eng.," Sept. 29.—A brief, illustrated note on the common battery system of the Bell Company, which is being installed in many of their exchanges; in this all the circuits are operated by a common battery at the central, thus doing away with local batteries. In the circuit illustrated the receiver bridges the two wires; connected in parallel to this is the transmitter, which is in series with the primary of a transmitter coil; the transmitter itself is shunted by a condenser in series with the secondary coil. The discharge of the condenser with the voice currents tends to magnify the vibrations in the main transmission circuit leading to the central office; "when the resistance of the transmitter decreases the increased flow of current through the primary tends to make a current flow through the secondary, charge the condenser, and this in turn increases the current in the primary, and consequently in the main line wires. When the resistance of the transmitter increases, the primary, acting on the secondary, tends to help the condenser discharge through the transmitter and oppose the voltage from the central office, thereby cutting down the current in the line wire;" thus both the rises and falls in the transmitter current are magnified.

FIRE-ALARM SYSTEM OF BALTIMORE. Fairchild. "Elec. Eng.," Sept. 29.—A brief, illustrated description of this system, which is said to be one of the best in this country.

Miscellaneous.

BRITISH ASSOCIATION MEETING.—Lond. "Elec.," Sept. 16.—A long abstract of Ayrton's address to Section A (see also "Digest" Oct. 1). He referred to the subject of terrestrial magnetism and the effect of electric railway and other large currents on the measurements at magnetic observatories. Also to the advantages accruing from publishing indexes and abstracts of current scientific literature, calling especial attention to the new journal, "Science Abstracts." The same journal also begins a brief account of the proceedings of this meeting, with very brief references to the papers. There is also a complete list of the electrical papers, which were very numerous. The issue of Sept. 23 contains a leading editorial on this association in general and its work, including a criticism of the proceedings of the sectional meeting.

TURIN EXHIBITION. Montel. "Elek. Zeit.," Sept. 22.—The second report on the electrical exhibits; single and multiphase current machinery is briefly described.

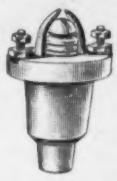
MAGNETIC ORE SEPARATOR.—"Eng. and Min. Jour.;" reprinted in "West. Elec.," Sept. 24.—A brief and not very clear description of a Russian separator which has been in use for some years in Finland. The ore is ground in water and is then passed through a separator consisting of drums; the particles not containing iron are washed away by fresh water, while the iron ore is held back. The material is enriched from 25 per cent. to 66 and 68 per cent., and the waste contains only 1 per cent. of iron.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION.—"Elec. Eng.," Oct. 6.—An abstract of the presidential address at the recent annual meeting in Buffalo, and a list of the numerous papers read.

OMAHA EXHIBITION.—"West. Elec.," Sept. 24, and Oct. 1.—Brief, illustrated description of the Westinghouse exhibit and the personal exhibit of B. J. Arnold.

An Improved Electric Gas Lighting Burner.

Lava is generally used in making tips for electric gas lighting burners, but it is regarded by some manufacturers as a poor insulator where currents of high potential are employed, such as those produced by the frictional machine or Ruhmkorff coil. To meet this objection the A. L. Bogart Company, 123 Liberty Street, New York City, has produced a tip of porcelain, the insulating qualities of which substance are well known.

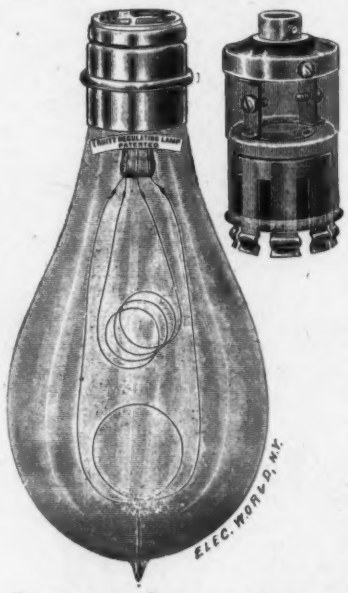


The accompanying illustration represents the new form of burner which is intended to be used in series electric gas lighting. The base is arranged to fit the metal socket designed to receive and hold the common lava tip of the ordinary pillar burner, or of a candle burner. The porcelain used in the improved burner is less liable to breakage either through accidental blows or by the increase of temperature due to the flame. The tip, therefore, is more durable. The high insulation of the porcelain tip permits of the lighting of a greater number of burners in one series.

Near the top of the tip are provided grooves in which the electrodes are firmly held in position. This feature of construction preserves the original length of the spark gap. Another new feature consists of the means of attaching the wires to the electrodes, binding screws being used for this purpose. Thus a firm contact is obtained. The wires can be connected up easily and with dispatch. The nuts of the binding screws cannot be lost, as there is a head at the upper end of the screw. The tip being white in color is more attractive than those of the old style, but it may be colored with any desired tint to harmonize with the surroundings.

A Regulating Incandescent Lamp.

Mr. Clarence Truitt, St. Louis, Mo., has brought out a regulating incandescent lamp, which is substantially constructed and should satisfy the evident want for a reliable regulating lamp. This lamp may be made to give 1, 8, 16 or 24 candle power by simply rotating the bulb in its socket different parts of one complete turn, by which means each of the two filaments is connected singly or the two are thrown in series parallel. In the porcelain base of the lamp are sunk three metallic terminal plates, each forming an arc of a circle. To one of these terminals one end of both filaments is connected, the other two plates constituting the terminals of the other ends of the filaments, thus giving three points of contact in the base of the lamp, which in every other respect resembles the ordinary Westinghouse base. The socket looks something like the Westinghouse keyless socket. It contains two contact points mounted upon springs and perfectly insulated. These two points bear against the plates on the base of the lamp, which, on being turned, changes the connections so that the filaments are either cut out of circuit or connected up in series, multiple or separately, thus giving the different degrees of candle power. Where it is desired to use the lamp in a chandelier, ceiling centrepiece or wall bracket that is out of reach, the changes in connections are effected by means of a five-point switch conveniently placed for access and operation. Any number of lamps may be controlled by the same switch.



Regulating Lamp and Socket.

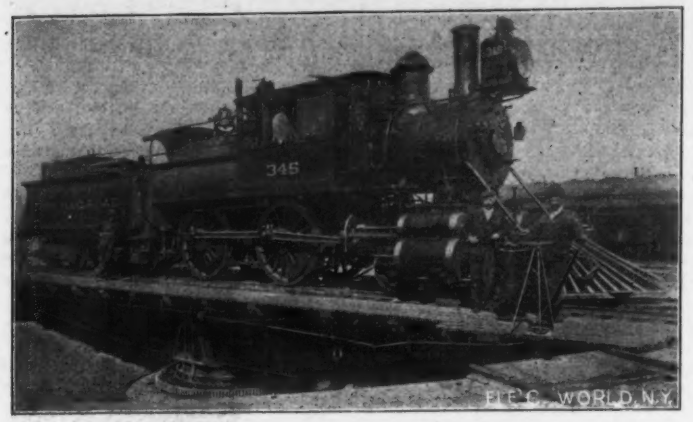
Regulating lamps are especially useful for show windows, theatres, dining rooms and in all other places where illumination of varying intensity is desired. The low intensity light gives a good night light, while that of the highest brilliancy finds its use in the office, reading room, reception room, etc.

The lamp burns equally well on alternating or continuous current circuits, and as it is not burned at its maximum candle power at all times its life in ordinary use is correspondingly extended. One filament is anchored at the sealed end of the bulb, while the other, which has three coils, lies between the two legs of the first filament, as shown in the accompanying illustration.

The cut gives a view of the lamp and its base, and of the socket, and from it a very clear idea of the features of the lamp may be obtained.

An Electrically Driven Turntable.

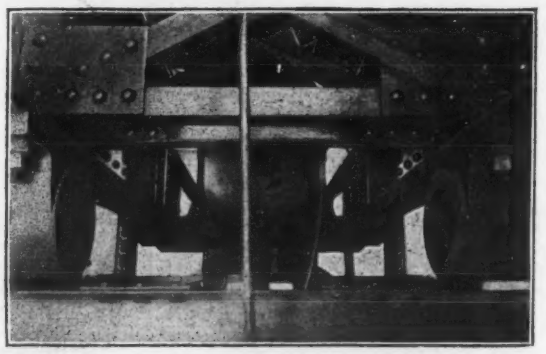
In THE ELECTRICAL WORLD of August 27 last was described an electrically driven turntable, in which the motor was mounted upon a small car, and towed the end of the turntable around the pit circumference. The Erie Railroad, as one of the improvements incident to the general development of its Jersey City yards, has recently installed a new turntable driven by electricity, which furnishes an interesting example of a novel application of electric power.



ELECTRIC TURNTABLE, CONTROLLER SHOWN AT THE RIGHT.

The turntable has been constructed not upon the ordinary turntable principle, but rather upon that of the swinging drawbridge, combined with that of a gun carriage. The two longitudinal girders supporting the table platform are pivoted upon 7½-inch shafts, each girder carrying its own bearing. The girders rest upon an equalizing drum, and the entire weight rests on a set of rollers, as in drawbridge practice. The girders are free to tilt down at each end until their end wheels rest upon the pit track. In laying out the electric application the problem to be solved was to keep the motor in a fixed position relative to the gears, so that their alignment would be unaffected by any tilting end motion of the table, caused by the weight of the locomotive passing onto the platform. To effect this the motor is set on the circular base between the girders, and is thus independent of any vertical motion of the ends of the table. The power is communicated by a double reduction system of gearing from a 15-hp series-wound motor, installed with its armature and shaft in a vertical position. A pinion at the upper end of the armature shaft engages in a gear set at the upper end of a shaft running in the axle bearing of the motor. At the lower end of this shaft is another pinion engaging in a gear set midway on a third shaft, at the lower end of which is keyed a pinion which engages in the stationary rack.

The table is double ended, each end being equipped with a controller with a reversing mechanism, so that the table may be moved in any direction. It is desirable for the operator to be immediately over his work at the end of the table. When he has reversed an engine he walks back to the other end of the table, and operates it from that end, thus saving the power that would otherwise be necessary to turn the table back. The current is taken from the 500-volt power circuit of the Jersey City Electric Light Company, through a Thomson recording wattmeter, and is brought to a pole near the turntable. Descending this the wires run underground through a cast-iron pipe to the centre of the table, where they are brought up through the vertical steel tube forming the central pivot. At the top of this table the conductors are connected to copper collars or collector rings, from which other conductors pass, over porcelain ring insulators beneath the board foot walk, to the controllers and motor. On the pole near the turntable is a box containing the protective devices, switches, etc.—one M. M. circuit breaker, with magnetic blow-out; one 75 ampere double-pole switch and two M. D. magnetic blow-out lighting arresters, one on each conductor.



VIEW OF THE MOTOR AND GEARS.

The amount of power required to turn the table through an arc of 180 degrees is very small. In practice the power is cut off when the table has moved over an acre of about 30 or 35 degrees, the momentum then acquired sufficing to carry it around through the remaining degrees of the semicircle much more quickly than is possible by hand power. The motion of the table as it approaches the stopping point is retarded by a band brake acting on a friction wheel set at the top of the second gear shaft. The diameter of this wheel is such as to insure rapid and powerful action.

Turning the table over an arc of 180 degrees is accomplished in about one-half a minute in everyday practice, with the result that an accumulation of locomotives waiting to be turned is impossible. Before the installation of this electrical table, the handling of the locomotives was a question of serious moment in the yards, as moving them quickly enough to prevent accumulation was manifestly impossible. Now the work is performed without any delay even to a single locomotive. The number of engines turned ranges between 175 and 225 per day.

The economy of the new system over the old may be roughly estimated as follows:

HAND TURNED TABLE PER MONTH.

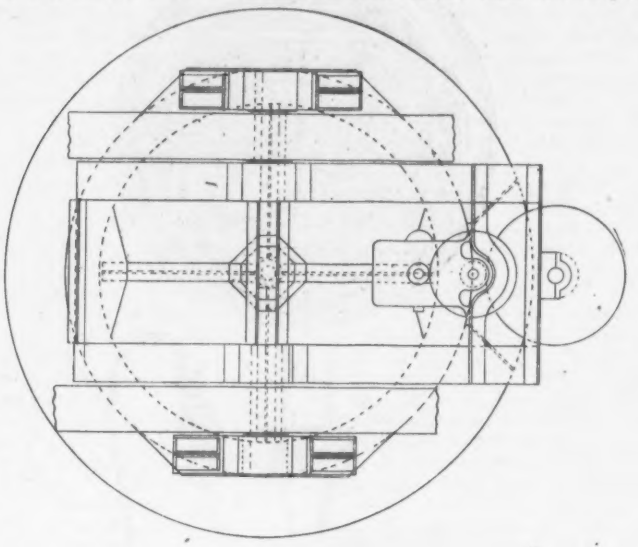
Two shifts of four men each, eight men twelve hours per day.....	$400

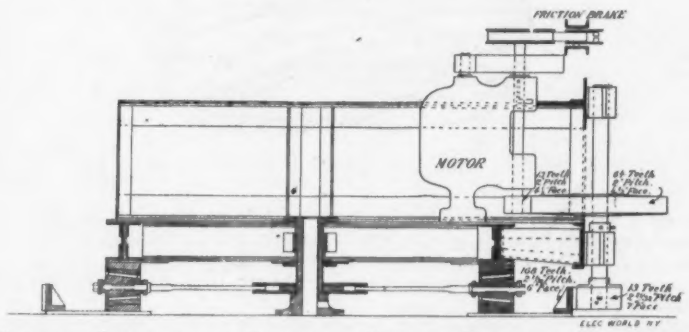
ELECTRICAL TURNTABLE PER MONTH.

Two men.....	100
Current, 30 amperes for 15 seconds each turn 200 hours per day, 50 minutes per day or 25 hours per month; minimum rate charged.....	200
Depreciation 10 per cent. on electrical equipment only (say, on $1200 per month).....	10
	$130
Difference in favor of the electric power per month.....	$270

Even if no saving were actually made in the operating expenses, the convenience and rapidity of the electrical, as compared with the former, method of handling the locomotives would be a sufficient warrant for the expense incurred in making this installation.

The important feature of the design of this table is that the weight of the driving machinery is carried on the central roller wheels, which also carry the





PLAN AND LONGITUDINAL SECTION OF CENTRAL PORTION OF THE TABLE.

table itself. Electrically driven turntables have been built with the driving motor and accessories placed at one end. This necessarily imposes great extra weight on the circular rail in the pit, and a comparison between a table thus equipped and that which the Erie Railroad has just installed will undoubtedly show many advantages in favor of the latter.

This table was designed by Mr. Mason R. Strong, assistant engineer of the Erie Railroad Company, under the direction of Mr. Charles W. Buchholz, chief engineer, and was built by the New Jersey Steel & Iron Company, Trenton, N. J. The complete electrical equipment was designed and furnished by the General Electric Company.

The Henry Street-Railway System.

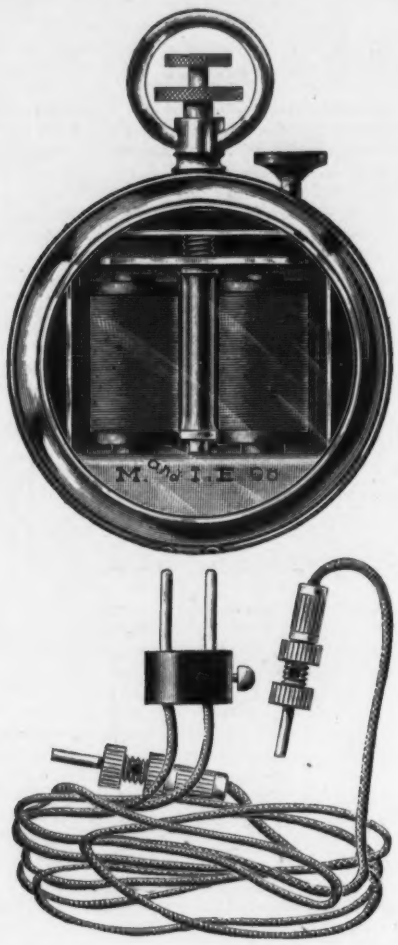
On October 2 a public trial was made on the Park Hill line of the electric railway system of Denver, Col., of the regenerating system of traction developed and patented by Mr. J. C. Henry. It will be remembered that Mr. Henry was one of the pioneers of electric traction, and has been working for several years on a method of properly controlling car motors with shunt or separately excited fields, wherewith a wide range of speed and torque could be obtained, and with which power could be returned to the line on down grades and retardation.

The daily press accounts describe the test as very satisfactory from the passengers' standpoint, the acceleration and retardation being smooth and uniform and readily controlled. In general the system combines a series-parallel combination with the shunt field excitation, the strength of this shunt field being adjusted from the controller handle by means of the ordinary rheostat in series with the field winding. A greatly increased field strength is also obtainable for emergency purposes, either in starting overloads or sudden stopping, by putting the two field windings in multiple instead of in series with each other. An automatic overload alarm is also used in connection with the system, con-

sisting of an ammeter closing a local circuit through an alarm bell. The controller is so situated that it can be operated from within the car as well as from the platform, thus allowing the motorman to be protected in severe weather with a vestibule.

The "Morse Watch" or Secret Sounder.

A very unique and serviceable electrical instrument is being placed upon the market by the Manufacturers and Inventors Electric Company, 96 and 98 Fulton Street, New York. It consists of a telegraph sounder, enclosed in a watch case of ordinary size. The play of the armature may be reduced to so extremely small a degree as to render the clicks inaudible a couple of feet away, yet they may be distinctly heard by placing the case to the ear, after the fashion of



Secret Sounder and Connecting Cord.

using a telephone receiver. It may, however, be varied at will, so that the instrument may be made to give a loud enough click to be heard all over a room. A flexible and adjustable headband of silk or mohair is devised in convenient form for fastening the watch over the ear, leaving the hands free for other work.

The construction of this sounder is quite novel, in order to obtain the necessary compactness and effectiveness. The magnets are the same size as those shown in the illustration, and are carefully wound with silk-covered wire. They are wound with low resistance for local circuits and high resistance for main-line work. They are rigidly supported on a metal segmental base set in the lower part of the case, as shown. Between the magnets, rising from the metal base, is a post running up about half as high as the magnet. Attached to the under side of the armature is a short piece of tube, which fits over this post.

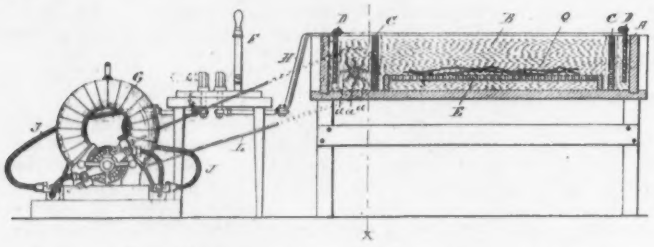


Fig. 1.—The Unhairing and Tanning Apparatus.

On one side of the tube is a slit, through which projects a small stud on the post, and having the same diameter as the width of the slit. The tube, therefore, can move up and down within the limits of the slit. In the upper section of the tube is a retractile spring, one end of which is fastened to the upright post. The tension on this spring and consequently the upward pressure upon the armature may be regulated by turning the upper knurled head in the proper direction. The lower knurled head regulates the play of the armature. The armature is not supported on trunnions or pivots, its action being an up and down movement, like that of a piston rod of an engine. This type of sounder is also made with a key, as shown in the illustration. The key consists of a short spring lever, fixed at one end. A finger knob projecting through the case enables the operator to transmit signals in the usual way. The knob performs the function of a circuit closer as well. The circuit is closed by turning the knob screw until it makes contact with the lower contact point. To use the key it is only necessary to unscrew the knob until the contact points are separated, and then the key is manipulated in the usual manner.

To connect the sounder in circuit a conducting cord is used. The cord connector has two terminals, which are pushed into corresponding holes in the case. Tips are provided at the other end of the cord.

This make of tip, to which is given the name "Manditip," is worthy of special mention. It is in reality a combined binding post and tip, and can be used to connect with another binding post, or as the binding post itself. The illustration shows these features of construction. Another improvement in this tip is the provision to effect repairs in case the cord breaks at the tip.

The "Morse Watch" is claimed to be the best instrument of its kind ever put upon the market, and its compactness and portability are commendable features. It will be found particularly useful by typewriter operators, train dispatchers, linemen, bulletin operators and in railway stations, newspaper offices, military telegraphs, police stations, hotels, etc., and all noisy places where it is desirable to maintain either uninterrupted quiet or absolute secrecy of telegraphic communication.

Mr. T. J. Smith, the manager of the Manufacturers and Inventors Electric Company, who was manager of the late firm, The E. S. Greeley & Co., being an old telegrapher himself, in confirming the design of this instrument knew precisely the requirements and conditions to be met in practice. He claims that the "Morse Watch" will give satisfaction, and will find a wide field of application.

Electricity in Tanning.

The use of the electric current for hastening the chemical process of tanning has long been discussed, but, as may not be well known, is now possible commercially with methods and apparatus exploited by the United States Electrical Leather Process Company, of 138-144 Lincoln Street, Boston, Mass. The development of this application of electricity is the work of Mr. George D. Burton, who is best known to electrical engineers, through the Burton electric forge, electric brazing machines and others similar metal working devices. Mr. Burton has not limited the exercise of his inventive abilities to the electrical field, and it may be a surprise to electrical engineers to know that he is the inventor of the now widely used Burton stock car.

But his latest work has been in the application of electricity to the treatment of leather, the results of which are described below. In these processes the electric current is not only used for hastening the tanning, but also for facilitating the unhairing of the animal skins as well as the extraction of the tanning elements from bark and other substances. The apparatus for the unhairing and tanning processes is shown rather diagrammatically in Fig. 1. Here *D* and *D* are the lead and carbon electrodes, respectively; *E* is a grating or perforated false bottom on which the skins, *Q*, rest in the solution, *B*, and *a* is a paddle wheel, which keeps the liquid in motion over the hides to be treated. The unhairing solution is the ordinary mixture of lime and arsenic, through which a small current density is maintained for a period of fifteen to twenty minutes. The current is then turned off, the skins remaining in the solution from thirty minutes to an hour and a half longer, when the hair is sufficiently loosened for the mechanical process of removal. By the ordinary process from ten days to three weeks are required to accomplish this same result. After the hair is removed the hides are laid in a similar vat with a proper tanning solution, the strength of which is varied from 2 per cent. to 18 per cent. Direct current with a voltage varying from 6 to 220 volts between the terminals, according to the nature of the leather, is put through the solution for about fifteen minutes, the effect being apparently to open up the pores of the hides, facilitating greatly the permeation of the tanning agents, this greatly accelerating the process. The figures of time required for tanning by this process are with bark liquor about twelve days for cowhide, one and one-half to three days for calfskin and one day for kangaroo.

The extracts of the bark and other substances used in tanning are prepared

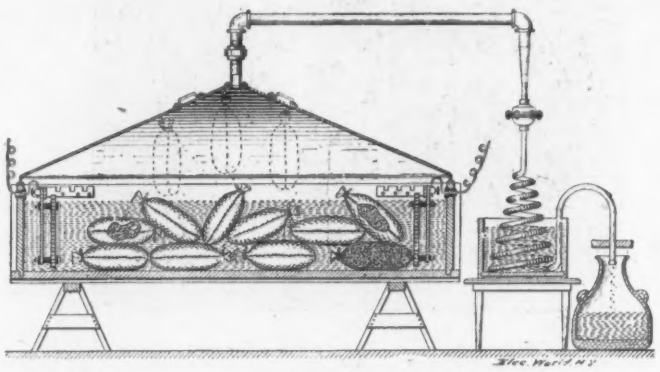


Fig. 2.—Apparatus for Preparing Tanning Extracts.

in an apparatus similar to that shown in Fig. 2, where the particles of bark are shown in sacks covered by the liquid in the tank, through which liquor the electric current is passed. Sufficient energy is sent in to cause the solution to boil, this process requiring about thirty minutes. The purpose of the still shown at the right is the saving of the vapors given off in the boiling process. The ordinary process requires about three weeks' time.

NEWS OF THE WEEK

Financial Intelligence.

THE BOSTON ELECTRIC LIGHT COMPANY, Boston, Mass., has declared a regular quarterly dividend of 1½ per cent., payable December 15.

DIVIDEND.—The New York & New Jersey Telephone Company has declared a quarterly dividend of 1½ per cent., payable October 15, to stock of record October 5.

TO INCREASE CAPITAL.—A special meeting of the stockholders of the New York & New Jersey Telephone Company will be held in Brooklyn, October 27, to vote upon a proposition to increase the company's capital stock from $5,000,000 to $8,000,000. The proceeds will be applied to extensions and the new stock will be offered stockholders at par.

THE THIRD AVENUE RAILROAD COMPANY, New York, has given notice to its stockholders of an increase in its capital stock from $10,000,000 to $12,000,000. The additional capital is required to equip its lines with electricity. It is stated that the directors of the Dry Dock, East Broadway and Battery line, the Union Railway Company ("Huckleberry" road) and the Forty-second Street, Manhattanville and St. Nicholas Avenue Railway Company have adopted resolutions providing for a consolidation with the Third Avenue road. The majority of stocks in these companies is controlled by holders of Third Avenue stock. The capital of the consolidated companies, it is reported, will be fixed at $53,000,000, of which $35,000,000 will be a new issue. As the Third Avenue road owns $6,000,000 of its own stock it is pointed out that the outside stockholders will have to contribute about $25,000,000. The Third Avenue road has several valuable franchises which it will develop.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
9 Murray St., NEW YORK, October 10, 1898.

MR. J. A. WILLIAMS, of Cleveland, is on an Eastern trip on the business of the Williams Electric Company, of which he is president and general manager. In Boston and other cities of New England, and also in New York, Mr. Williams secured a large number of orders for the well-known magneto bell, manufactured by the Williams Electric Company.

THE AMERICAN ELECTRICAL & MAINTENANCE COMPANY, 451 Greenwich Street, this city, was on October 4 placed in the hands of Aldred K. Warren and Francis Higgins, who were appointed by Justice Smyth as receivers of the company. This action was the result of proceedings brought by directors for the voluntary dissolution of the corporation on the ground of insolvency. The liabilities are stated to be $35,199; nominal assets, $29,126; actual assets, $17,398. The business was established in 1892, the present company being incorporated in July, 1897, with a capital stock of $250,000.

CONSUMMATION OF THE KINGS COUNTY-EDISON CONSOLIDATION IN BROOKLYN.—The consolidation of the Kings County Electric Light & Power Company and the Edison Electric Illuminating Company of Brooklyn was completed on October 3 by Mr. Anthony N. Brady in behalf of the former, Mr. George F. Peabody representing the latter. By the deal thus completed the Kings County Company becomes the owner of the Edison stock, and by virtue of the ownership of this stock will own the stock of the Citzens Electric Illuminating Company and the Municipal Electric Light Company, both of Brooklyn borough. The Kings County Company now controls practically all of the electric light business in the borough. On July 15 last a circular was issued by the Edison Company announcing the proposed sale to the Kings County Company, provided the agreement was ratified by two-thirds of the stockholders. Their acceptance having been obtained the deal was consummated as above noted. The terms of the consolidation were outlined in the financial columns of THE ELECTRICAL WORLD of July 30, 1898. On January 1 last the Edison Company was supplying 227,095 16-cp lamps, 6406 arc lights and 3750 horse-power to motors.

THE TELEPHONE IN BUSINESS AFFAIRS.—According to the last statement of the Bell Telephone Company the number of sets of instruments outstanding on September 20 was 527,793. Of this number about 25,000 are in use in Manhattan and Bronx boroughs. Many of the large business concerns in this city, however, utilize more than one instrument, and this fact emphasizes most strongly the importance of the telephone as an aid to the transaction of business between distant points. It is only thirteen years since the telephone made its bow to the public, and its rapid adoption in all civilized countries of the world is one of the marvels of industrial progress. As a time saver to business it takes first rank. It has become an actual necessity, and any business concern of any importance without a telephone is likely to be regarded as behind the times. An analytical study of the telephone directory of the New York Telephone Company reveals many interesting facts, most significant of all, perhaps, being that of the liberal use of instruments by many of the prominent private and public concerns in Manhattan and Bronx boroughs. The city of New York stands at the head of the list with no less than 131 telephones. Only three of the departments have one telephone each, while the street cleaning department employs twenty-five and the health department twenty-four. There is only one telephone door to the finance department. Whether this is a precautionary measure of Father Knickerbocker to prevent leaks in the city's strong box or not, our source of information sayeth not. Next to the city comes the post office, with thirty-six instruments, these instruments, however, being scattered over the two boroughs among the substations. The Metropolitan Street Railway Company requires twenty-two telephones to keep its service at the highest degree of efficiency, and to provide New Yorkers with ice cream, cool drinks, etc., the Consolidated Ice Company and the Knickerbocker Ice Company together employ thirty-one instruments. The large dry goods houses and department stores have five or six instruments each, and the express and railway companies are liberal patrons. It is a notable fact that the Western Union Telegraph Company does not use a single telephone at its headquarters. In many of the large private business houses five or more separate and distinct instruments are used. The list above given does not take into account the private exchanges, of which there are many.

A NEW LIGHT AND POWER COMPANY.—There is much speculation and curiosity in this city over the incorporation at Albany, on October 3, of the New York Gas, Electric Light, Heat & Power Company, with a capital stock of $25,000,000. The directors of the new company for the first year are: Henry J. Hemmens, Frank D. Allen, F. L. Allen, J. F. Yawger, Louis M. King, C. N. Flint and N. W. Smith, of New York City. The fact that these gentlemen are not recognized as promoters, and are comparatively unknown in the community, throws a halo of mystery around the the identity of the real promoters and the purposes of the new concern. Efforts to ascertain both have shed no certain light upon the prevailing general ignorance respecting the same, and interested outsiders are guessing as to what is going to happen. That the company means business there seems to be no doubt, for the reason that the incorporators paid to the Secretary of State corporation taxes to the amount of $31,250. The only ray of light that has penetrated the gloom comes from the director first named, Mr. Henry J. Hemmens, who is reported to have said that the field of operation of the new company will be Greater New York, and that the company would "take electricity from no railroad company." The latter part of this statement refers to a report that the company would utilize the surplus energy of the power station of the Third Avenue Railroad Company. As to the real backers of the new company it was thought by some that R. P. Flower & Co., bankers, had a hand in its affairs, but at the office of the firm it was stated that they knew no more about the scheme than the public does. Prominent gas men think that the directors named are merely dummies. The fact that the Metropolitan Street Railway Company is laying a very liberal supply of conduits along Broadway immediately adjacent to its tracks is regarded by some as an indication that the company may in some way be concerned in the new enterprise. What the railway company proposes to do with all the ducts is yet unknown to any but the elect. In some places along Broadway as high as forty ducts have been laid; the number varies at different points along the line. With its immense resources the Metropolitan Company might make itself mightily felt in the electric lighting industry. Representatives of the company deny that it has anything to do with the new company. Another suggested explanation of the object of the new company is that it represents a move on the part of the Kings County Electric Light & Power Company, which is consolidating the electric light interests of Brooklyn, to greatly enlarge its scope and take in more territory. Such a company as the New York Gas & Electric Light, Heat & Power Company would, it is believed, enable the Kings County Company to do this. Officials of the Third Avenue Railroad Company deny that their company has any connection with the new enterprise. The directors of the new concern appear to be bound to secrecy regarding its affairs. As one of them stated: "To make the facts public now would injure the enterprise." Different views and explanations—all seemingly plausible—were expressed during the week, the last one being the alleged discovery that the new company will probably absorb the charter of the "Block" Electric Light & Power Company, which, it is said, has a very valuable charter obtained in 1894 under the old laws. This company operates a small plant in the theatrical district in this city. William F. Sheehan, the former lieutenant-governor, and several friends whose names are withheld, it is stated bought up the little Block Electric Company last January, and ever since that time there has been gossip as to what use they intend to make of it. Mr. Sheehan is intimately associated with former Governor Flower in many of his electric enterprises, and it was stated on apparently good authority that the Block Company is to be used by the big $25,000,000 New York Gas & Electric Light & Power Company as an operating company. It is said that the New York company will probably not attempt to get a franchise of its own from the Municipal Council, to whose use it would be limited to twenty-five years, greatly handicapping it in the floating of its securities. The franchise of the little company, however, is very liberal, and any electrical service may be carried on that is desired, even to the furnishing of power for traction purposes, which is said to be a part of the plan of the new company. But Time is a good secret-revealer, and will no doubt in due time throw the rays of his searchlight upon the innermost thoughts of the new comer and expose them to public criticism.

NEW ENGLAND NOTES.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, Mass., October 8, 1898.

THE ELECTRIC GAS LIGHTING COMPANY, Boston, has recently increased the floor space of its factory 50 per cent., the extension of which was made necessary by the rapidly increasing sales of its varied line of electric gas lighting, open circuit battery, and house goods specialties.

THE PHILLIPS INSULATED WIRE COMPANY, Pawtucket, R. I., be-

cause of continued increased demand for its wire manufactures has been compelled to extend its already large factory facilities, and is at present doing so in a most active manner. It is virtually duplicating its present plant by the erection of a four-story building 120x50 feet, and a one-story building 120x65 feet. The whole, when completed, will represent 75,000 square feet of floor space, and the buildings will present an attractive appearance architecturally.

PHILADELPHIA NOTE.

Branch Office of THE ELECTRICAL WORLD,
929 Chestnut Street,
PHILADELPHIA, Pa., October 8, 1898.

MR. ELLWOOD IVINS, of the Ellwood Ivins Tube Company, Oak Lane Station, Philadelphia, has invented an ingenious method of blowing a steam factory or other whistle at any predetermined time. The device consists of a combination of steam, electricity and clockwork. The clock is provided with an index, which may be set at the time at which it is desired to blow the whistle. When the pointers of the clock reach the set time the circuit is closed and by means of an electromagnet the steam is turned on and the whistle blows. The method is also applicable as a protection against fire, by including a thermostat in the circuit. It is entirely automatic, and requires no more attention than the winding of a clock. Mr. Ivins intends to take out patents. The device is in practical use at the company's factory, and is giving excellent results.

BUFFALO AND NIAGARA FALLS NOTES.

BUFFALO, N. Y., October 8, 1898.

THE UNION CARBIDE COMPANY, Niagara Falls, N. Y., has just closed a contract with the Niagara Falls Power Company for 5000 additional horse-power for use in its Niagara plant. The Union Carbide Company has recently remodeled its plant at the Falls, and introduced many improvements, which, it is estimated, will cost about $100,000.

THE CATARACT POWER & CONDUIT COMPANY has closed the contract with the McKinnon Dash Company at Black Rock in this city for furnishing 100 horse-power from Niagara to run the works. The machinery is to be of very peculiar construction, and will be some time in building. The bids for it will not be in till next week. There will be a 25-cycle induction motor to receive the current at 2200 volts. This is provided with a pulley at each end, one for driving the 60-cycle alternator which supplies the Thomson welding machines with current. The other pulley will drive a 40-kw, 110-volt generator, which will supply current to an arch welder and small motors for ordinary motive power, such as running the stitching machines, and also to excite the alternator. The current will probably be taken from the main Niagara line at the Niagara Street car barns, which station is putting in additional transformers of about 1500 horse-power.

CHICAGO NOTES.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, Ill., October 7, 1898.

THE ELECTRICAL EXCHANGE, 174 South Clinton Street, this city, which has since November, 1896, been engaged in the electrical business, has made an assignment to Mr. L. O. Gilman. The assets are placed at $12,000 and the liabilities the same amount.

AN ELECTRIC LIGHT PLANT FOR NORTH CHINA.—Mr. A. Louis Kuehmsted, treasurer and general manager of the Charles E. Gregory Company, this city, states that his company has just received an order for an electric light plant for North China. This is said to be the first plant of this character installed in that part of the world. It consists of a 1000-light dynamo, together with a complete equipment.

ST. LOUIS NOTES.

ST. LOUIS, Mo., October 6, 1898.

THE CENTRAL TRACTION COMPANY sent to the Board of Public Improvements this week the plans for its route. This is considered the first step in beginning the construction of the road. The plans were referred to the Committee on Streets and Railroads of the Board of Public Improvements.

THE LUNDELL RAILWAY bill providing for the consolidation of all the lines now under the control of the Lundell Railway Company and the connection of all those lines with tracks was killed in the Council last Monday by a vote of six to seven. The bill has already been killed in the House, and is now off the docket entirely.

PACIFIC COAST NOTES.

SAN FRANCISCO, Cal., October 1, 1898.

THE PIONEER GOLD MINING COMPANY, of California, will soon install a 3-mile electric power transmission for operating its stamp mill. Standard Westinghouse alternating apparatus will be installed, induction motors being called for.

IT IS REPORTED that an examination of the Sandy River, which empties into the Columbia in western Oregon, has been made by persons who contemplate installing an electric power plant. A dam would be required to render the water power available.

MR. H. E. VINEING, who spent some months in San Francisco as representative of the Hearst estate while the "Examiner's" electric power plant was being installed and tested, has returned to New York City. Mr. Vineing formerly held an important position at the Brooklyn Navy Yard.

THE HUNTINGTON SYNDICATE, which purchased the Los Angeles Railway Company, has, it is reported, about concluded a deal with M. M. Sherman, principal owner of two suburban electric railways. One runs from Los Angeles to Pasadena and the other from Los Angeles to Santa Monica. It is said that the syndicate will consolidate these lines with the others which it owns, and operate the combination under the name of the Los Angeles Railway Company. The combined trackage will be about 128 miles of electric road. It is said that the capital stock of the new company will be $5,000,000, and that bonds will be issued to the amount of $5,000,000.

MEXICAN NOTES.

MONTEREY, Mexico, October 4, 1898.

A NEW telephone line connecting this city with San Bernabe has just been placed in operation.

THE AUTHORITIES of the city of Durango have just added forty street arc lights, which now makes that city one of the best lighted places in Mexico.

THE CITY COUNCIL of Linares, State of Nueva Leon, is negotiating with an American company for the establishment of an electric lighting plant for that city.

MEXICAN AND SPANISH capitalists of the State of Vera Cruz have formed a company for the purpose of obtaining a concession from the Federal Government for the utilization of the Tonata Falls in the Tlapacoya district for an electric power plant, which is intended to furnish power for industrial enterprises. These falls are capable of producing an enormous power.

TELEGRAPH LINE construction on an extensive scale is being carried on in all parts of Mexico, particularly in the State of Chiapas. That State recently transferred its telegraph lines to the Federal Government, and many extensions are now in progress. A net work of telephone lines is also being constructed and will soon bring San Bartolome, the capital of La Libertad, into talking distance with the rest of the State.

CANADIAN NOTES.

OTTAWA, October 8, 1898.

A SCHEME is on foot in the County of Halifax, Nova Scotia, to construct an electric railway from the town of Waverly to the city of Dartmouth, and from that point to Musquodoboit Harbor.

THE CITY OF TORONTO, ONT., wants tenders by Wednesday, November 9, for the construction of a complete electric lighting plant, or for the various portions of the work, viz., engine equipment, countershaft and pulleys, belting, boilers, feed pump and condensers, water and steam piping, economizers, dynamos and station electrical apparatus, arc lamps, mast arms and lamp attachments, poles and overhead circuits, conduits and cables.

MR. E. C. JENISON, of Chicago, is promoting a scheme to build a water power canal from above the Ecarte Falls, on the Kaministiquia River, to the boundary of Port Arthur, where an immense storage reservoir will be built. The intention is to supply electric light and power to Port Arthur, Fort William and other towns in the vicinity. The immediate expenditure for the canal would be about $1,000,000. The town of Port Arthur has made arrangements for the supply of 560 electric horse-power and 500,000,000 gallons of water per annum from the power canal. The contract is to be submitted to the ratepayers for their approval at once, and Mr. Jenison agrees to have the works completed within three years. He actually expects to have the power ready by January 1, 1899. The proposition is regarded as fraught with more possibilities than anything that has occurred in that district for a long time, as, to make the gigantic enterprise pay, Mr. Jenison will have to get manufacturing institutions established there to utilize the power thus generated.

General News.

THE TELEGRAPH AND TELEPHONE.

AMHERST, MASS.—The Amherst Telephone Company has been incorporated with a capital stock of $4000.

ALBION, MICH.—The Calhoun County Telephone Company, which has been making plans for an exchange here for some months, has commenced active operations. It is expected that it will be in operation within thirty days.

COMPETINE, IA.—The Competine Telephone Company, composed of Dr. C. A. Henry, D. H. Thompson and L. Dudgean, of Competine, and Dr. P. Sherlock, of Martinsburg, is erecting a new telephone line, which will connect Hedrick, Martinsburg and Competine.

EDWARDSVILLE, ILL.—The Central Union Telephone Company has completed its line from the north of Alton, and now telephonic communication is open with Godfrey, Jerseyville, Brighton, Kane and about fifty towns in Jersey, Macoupin and Greene counties.

SUMMIT, N. J.—The Township Committee has received an application for a telephone franchise from the Newark Telephone Company. Owing to the frequent fights with the New York & New Jersey Company the committee was disposed to listen to the Newark Company's proposition.

ALLEGHENY CITY, PA.—The new fire-alarm system in this city, which is being installed by the Gamewell Fire Alarm Telegraph Company, is said to be the finest that has ever been built for any city in the United States. The switchboard and some of the instruments have been placed in position.

LORAIN, OHIO.—Officials of the Black River Telephone Company have entered a contract with the Ohio Telephone Toll Line Company for the construction of a line from this city to Elyria to connect the local system with that company's line. Later the local exchange will be connected with the Home Telephone Company at Cleveland.

BLOOMINGTON, ILL.—The McLean County Telephone Company has completed arrangements whereby its lines will cover a large section of central Illinois heretofore undeveloped. It will connect with the Fulton County Telephone Company's lines, and give service to the towns now covered by that corporation. The new system will be in operation by January 1 next.

THOMASVILLE, N. C.—The Thomasville Telephone Company has been incorporated with a capital stock of $6000. F. S. Lambeth, J. W. Lambeth, C. A. Julian, J. F. Haden, W. E. Evans, R. W. Thomas, C. R. Thomas, W. M.

Morton, A. Johnson, J. B. Boone and J. A. Green are the incorporators. The corporation purposes to erect a telephone system in the town of Thomasville and the surrounding county.

BOSTON, MASS.—The Bell Telephone Company's instrument statement for the month of September 20, shows, gross output, 31,977; returned, 12,931, leaving net output, 19,046. This represents a net increase of 7000 over the number outstanding the same day last year. The gross output since December 20 is 244,724, and the net output 136,465. The total number of instruments outstanding on September 20 was 1,055,586, an increase over last year of 188,100.

IRONTON, OHIO.—The Mutual Telephone Company, at Ashland, has bought out the Bell Company up there, which withdraws from the field after a long fight. There were but few paying instruments in the system at the wind up. This cuts the Central Union Company at Ironton out of a connection with Huntington, but it at once moved across the river and established a long distance station at Ashland, utilizing the metallic circuit river span already up between Coalgrove and that city.

RICHLAND CENTRE, IA.—The Union Telephone Company, having purchased a controlling interest in the Southwestern Telephone Company, will proceed at once to make connection betwen all the surrounding towns ,including Platteville, Lancaster, Fenimore, Boscobel, Richland Centre, Lone Rock, Spring Green, and in fact all the important points in Grant, La Fayette, Richland, Sauk and Dane counties. Also a line from Dubuque and Madison. Poles are now being delivered along the line.

VICTORIA, B. C.—The recent extension of the wires of the Western Union Telegraph Company has had the effect of cheapening the rates and of securing prompt and satisfactory communication with the United States at all times. The Western Union Company, being incorporated under the laws of the United States, has no right to operate in Canada, and consequently it has established connection with the Port Angeles, Wash., line operated by the Great Northwestern Telegraph Company, which connects with the Western Union. The new line includes a cable across Puget Sound, from Seattle to Port Townsend, thence it goes by land and water to Victoria. Since this line was built the Canadian Pacific Railway Company has also laid a cable from Victoria to Port Angeles, so that now Victoria has two telegraph lines direct to the United States. Each wire is duplexed, thus permitting the transmission of messages from both ends of the line at the same time.

PONTIAC, ILL.—The Livingston County Telephone Company was incorporated February 1, 1898, and was bought by the present company July 19. The cables are 3500 feet in length, and some of them contain as many as 200 wires, all insulated. The switchboards are of the make of the Sterling Electrical Switchboard Company, of Chicago, and of the Bell type. The company has eighty-eight stations and connections at present, and 295 exchange 'phones. The present company has been successful in coming to an agreement with the Eastern Telephone Company, with offices at Patrick City, to complete a connection with that company, giving it an additional service of 385 miles of line and also affording it direct connections with several of the prominent cities of western Indiana. The connections with the McLain County lines at Bloomington are also very complete. The instruments used by this company are of the latest design, being made by the Stromberg-Carlson Company, of Chicago. The officers are as follows: L. S. Rupert, president; H. W. Snow, vice-president; A. M. Legg, secretary; John S. Murphy, treasurer, and G. B. Ortman, general manager.

ELECTRIC LIGHT AND POWER.

CANTON, ILL.—A new electric light plant, which cost nearly $25,000, is being put in place by the Parlin & Orendorff Company.

MANCHESTER, N. H.—The Lancaster & Jefferson Electric Light Company has filed articles of incorporation. The company's capital is $36,000. Lancaster is the place of business.

NORWICH, N. Y.—The Standard Light, Heat & Power Company has been incorporated with a capital of $60,000, and intends to furnish electricity for the villages of Unadilla, Gilbertsville, Otego, Sidney, Franklin, Bainbridge and Afton.

STEVENS POINT, WIS.—The Stevens Point Lighting Company has been placed in the hands of a receiver. The action is an outgrowth of foreclosure proceedings instituted by the First National Bank of Milwaukee, which holds its paper.

LITCHFIELD, ILL.—Sealed proposals will be received October 22 for the purpose of furnishing electric lights for lighting the city of Litchfield and also for furnishing an electric light plant to the city, in accordance with the plans and specifications on file in the office of the city clerk, Oscar W. Gooch.

BROOKHAVEN, MISS.—The city electric light plant, which began operation January 1, 1898, is now running at its full capacity. The plant consists of a 30-light arc machine and a 1000-light incandescent machine. The city now has thirty arc and 1400 incandescent lights connected, and still there is a demand for more lights.

UTICA, N. Y.—The Utica Electric Light Company has made contracts which will enable it to increase the output of the plant. A 1000-hp cross-compound condensing engine has been ordered from the Corliss Steam Engine Company of Providence, R. I. Contracts have also been made for two 125 arc light dynamos, and a 250-kw generator for power purposes.

PATCHOGUE, L. I.—An extension of the lines of the Patchogue Electric Light Company is about to be made, and to meet the expense the capital stock will be increased $10,000. It is proposed to extend the lights through Blue Point, Bayport and Sayville. The erection of a new plant on the Patchogue River is also contemplated.

FREMONT, OHIO.—Eastern capitalists have acquired possession of the Northwestern Ohio Natural Gas Company's plant in this city, as well as the plants of the Fremont Electric Light & Power Company, the Fremont Gas Company, the Creager Light & Power Company and the Fremont Street Railway Company. All of these plants are to be merged into one and operated under one head.

SEATTLE, WASH.—Dawson is to have electric lights this winter. A full plant, including five dynamos and apparatus for operating twenty arc and 2000 incandescent lamps was taken north on the steamer Dirigo. There is a small outfit already at Dawson, which was expected to be operating 800 incandescent lamps by September 15. The charge for the arc lamps will be $14 a day, and for the incandescents 50 cents. G. M. Easterly is the superintendent of the works.

CHARLOTTE, N. Y.—Bids will be received October 15 for a light and water system. The electric light equipment will consist of two simple high-speed engines, with fittings, foundations, piping, etc., arc light dynamo of a capacity of 60 lights of 1200 candle power, an incandescent light dynamo of a capacity of 1000 lights of 16 candle power; switchboard, arc lamps, pipe line, line work, belting, shafting, clutch pulleys for engines and dynamos and other appurtenances. Mr. John M. Allen is president of the board.

PORT CHESTER, N. Y.—The Port Chester Electric Lighting Company has just purchased the plant and franchises of the Westchester Gas & Electric Company, and will begin in a short time to build an entirely new plant to supply the villages of Port Chester, Rye, Harrison and Mamaroneck. The capital stock of the new company is $50,000, and the officers are William E. Ward, president; J. Addison Johnston, vice-president; William L. Ward, treasurer, and Walter S. Comby, secretary.

SOUTH MILWAUKEE, WIS.—The Common Council of South Milwaukee unanimously resolved to purchase the electric light plant of the South Milwaukee Electric Light & Power Company, paying for it in monthly installments covering a period of ten years, the amount paid each month being the same that the city would pay as rented for the lights. The city is to take immediate possession, operating the plant, collecting rentals and keeping up all repairs. The total amount to be paid is $19,000 in monthly installments of $242.50, with the privilege of paying the principal at any time.

WASHINGTON, D. C.—Consul-General Gowey, at Yokohama, Japan, informs the State Department at Washington, under date of September 1, 1898, that almost every prominent American and European manufacturer of incandescent electric lamps is represented in the Japanese markets by specially appointed agents or by correspondents. Sixteen-candle-power lamps of German make, and with a guaranteed life of 1000 hours, have been offered in Japan for 12 cents each. American and other lamps of the same quality are now selling there for 16 cents each. This unusually low price, the consul states, is the result of overcompetition.

JERSEY CITY, N. J.—The North Hudson Light, Heat & Power Company has been incorporated at Trenton with a capital stock of $2,000,000. The incorporators are: Albert B. Carlton, of Elizabeth; Frank M. Stillman, of Rahway; Samuel Hathaway and George W. Waite, of Jersey City; David Young and George W. Roe, of Newark, and Arthur K. Bonta, of Hoboken. The principal object of the new company is to enlarge the electric facilities in Hoboken and North Hudson. The present concern has been supplying steam for power for several factories near its plant, as a matter of convenience, and a clause has been inserted in the articles of incorporation to include that function.

THE ELECTRIC RAILWAY.

JACKSON, MISS.—The generators for the street railroad have been bought, and work will be commenced on the track as soon as the yellow fever scare is over.

ALBANY, N. Y.—The State Railroad Commission has approved an increase of capital stock of the Delaware Railroad Company, from $200,000 to $260,000. This company will build an electric road between the villages of Delhi, Bovina Centre and Andes, in Delaware County.

TRENTON, N. J.—The Hartford & Springfield Railway Construction Company has been incorporated, with a capital stock of $100,000 for the purpose of building and equipping railway lines. The incorporators are Henry Seligman, Benedict Nahm, Edward B. Gilman, Thomas A. Lee and George W. Dunham.

BRISTOL, R. I.—The sections between Warren and Bristol of the Consolidated road will be equipped with electricity, the same as from Providence to Warren, but will not be double tracked at present. New rails have been distributed along the roadbeds of both these sections, and will be laid at an early date.

CHICAGO, ILL.—It is reported that the City Railway Company has secured control of the South Side Elevated Railway, and will assume active management of the line January 1 next. It is said that the City Railway Company assumes $750,000 bonds outstanding and guarantees 4 per cent. dividends on the capital stock of $10,328,800.

DETROIT, MICH.—A proposed consolidation of the Detroit & Ann Arbor electric line with the projected Ann Arbor & Dexter Railway and the partially built Lansing & Dexter electric line will give the State an electric line 85 miles long, reaching from the capital to the metropolis of the State. There is said to be ample money behind the scheme.

DOYLESTOWN, PA.—The Newtown Electric Street Railway has awarded the contract to build the 14-mile extension of its system from Newtown to Doylestown. The road, which is to be completed by the middle of December, will pass through Wrightstown, Penn's Park, Wycombe, Forest Grove and Bushington, opening up one of the finest agricultural territories in the State. The cars to be run over the Doylestown route will weigh 18 to 20 tons each. It is expected to cover the 28 miles in one hour and fifteen minutes. The fare for the entire trip will be 50 cents. It is also expected that mail cars will be put on with a clerk to distribute the mail along the line.

ELECTRIC RAILWAY MEN ORGANIZE.—The employees of the electric street railway company of Terre Haute, Ind., have reorganized the union, which went by the board a year ago, when Mr. Russell Harrison was president of the company. Casper Ovebaugh, organizer for the State, was present, and assisted in the organization. The officers elected are: President, Ed. Rose; vice-president, J. Q. Adams; secretary, Bert Wright; treasurer, R. M. Merring; watchman, J. Haut. A few weeks ago the men asked Receiver Jump if he had any

objection to the men organizing, and he told them that, on the contrary, he thought it was the right thing for them to do.

LOUISVILLE, KY.—The Louisville committee appointed to arrange for the reorganization of the New Orleans Traction Company announces that all arrangements have practically been completed. The company owns the City and the Lake and the Crescent Street Railroads in New Orleans, but has been unable to meet its fixed charges, which amount to $600,000 a year. By the new plan the two systems will be combined and expenses reduced to $400,000 a year, which will put the company at once on a dividend-paying basis. The stockholders will raise $300,000 to pay off the floating debts, getting preferred stock in return. The old capitalization of $7,500,000 will be reduced about one-third.

FEMALE CONDUCTORS.—For several months the experiment of using young women as conductors on the street railway was introduced in Madison, Ind., and it excited much attention and comment. The innovation, however, was a pleasing one. The street railway is now under the control of a receiver. Last Saturday evening the girls were paid off as usual, but no notification of a change was given. On Monday the receiver began discharging the girls one at a time, until only one remained on Wednesday. For the present at least the fares will be collected by the motormen. It is claimed that the girls will be called back when the receivership is ended. The prejudice against female conductors had died out, and the girls were pleased with their work.

BROOKLYN, N. Y.—A case which will be of interest to street railway companies was decided in the Supreme Court in this city on October 5. Mr. John Jenkins was given a transfer to the Fulton Street line from the Montague Street line. The first car which passed him was crowded, and so was the second and third, and he waited half an hour before he got on a car in which a seat was vacant. The conductor refused to take Mr. Jenkins' transfer ticket and demanded another fare. Mr. Jenkins refused to pay a second fare and was put off the car and arrested, but was afterward discharged. He brought suit for damages, but the suit was dismissed by the trial judge. Mr. Jenkins, however, took the case to the Appellate Division of the Supreme Court, where he was awarded $400 damages. The defendant was the Brooklyn Heights Railroad Company.

BALTIMORE, MD.—Surveyors are now engaged making an estimate of the cost of construction of the proposed line of electric railway, which is to run from Baltimore through Anne Arundel County to Gibson's Island, or Mountain Bar, as it is sometimes called, on the shore of the Chesapeake Bay, 14 miles from Baltimore. A certificate of the incorporation of the company has been filed at Annapolis, and the commissioners of Anne Arundel County have granted the company the use of the necessary public roads and bridges. The capital stock of the company is $50,000, and the incorporators named are Messrs. Frank S. Revell, Elijah Williams, F. Eugene Wathen, George E. McDonald, Frank L. Hancock, B. R. Anderson, Robert Moss and James P. Bannon, of Anne Arundel County; Walter R. Townsend, of Baltimore County, and James Bond and John F. Williams, of Baltimore city.

Directory of Scientific Societies, Associations, Etc., and Meetings of the Same.

THE NEW YORK ELECTRICAL SOCIETY.—President, Gano S. Dunn; secretary, George H. Guy, 120 Liberty Street, New York.

HENRY ELECTRICAL SOCIETY meets every other Friday evening between October and May. Headquarters, 115 West Twenty-eighth Street, New York City.

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES, Brooklyn, N. Y. Henry T. Weed, secretary. Meetings and subjects of lectures: November 4, illustrated lecture by T. C. Martin; December 2, lecture by Prof. William E. Geyer, Stevens Institute; January 6, lecture on "The Electro-Metallurgy of Copper," by John B. F. Hereschoff; February 3, lecture and experimental demonstrations by Prof. M. I. Pupin; March 3, illustrated lecture on "Electricity in the Navy," by Captain Zalinski, U. S. N.; April 7, lecture on "Cable Telegraphy," by A. E. Kennelly; May 5, lecture by Prof. William A. Anthony.

CHICAGO ELECTRICAL ASSOCIATION.—Meetings, first and third Friday of each month, from October 1 to June 1; J. R. Cravath, secretary, Monadnock Block, Chicago, Ill. Meetings and subjects of papers: October 21, "Practical Points on Electrical Measurement," by W. B. Hale; November 4, "The Electrical Equipment of a Model Printing Establishment," by George A. Damon; November 18, "The Development of the Motor-cycle," by F. B. Rae; December 2, "Practical Points in Street Railway Engineering," by W. A. Harding; December 16, "Wireless Telegraphy," by Arthur V. Abbott; January 6, 1899, "Telephone Engineering—Some Problems Solved and Unsolved," by S. G. McMeen; January 20, "Observations on Ventilating Fans," Gerard Swope.

FRANKLIN INSTITUTE (Electrical Section), Philadelphia, Pa.—Secretary, William H. Wahl. Programme of lectures for the season 1898-99: October 25, "Lightning and Lightning Arresters," by Mr. A. J. Wurts; November 8, "Concerning Electrical Instruments," by Mr. J. F. Stevens, and "The Status of Electrical Invention," by Mr. William A. Rosenbaum; November 22, "Thermo-Electricity," by Mr. C. J. Reed, and "Electric Elevators," by Mr. William Baxter, Jr.; December 13, "The Kite As an Instrument in Meteorological Research," by Prof. Charles F. Marvin, of the United States Weather Bureau, and "Standards of Light for Electric Light Photometry," by Prof. A. J. Rowland; January 24, 1899, "The Practical Application of the Electric Motor to Printing Press Machinery," by W. H. Tapley; February 14, "The Electric Inspection of Street Car Equipments," by Mr. A. B. Herrick; February 28, "Some of the Larger Transportation Problems in Cities," by E. E. Higgins; March 28, "Water Power Electric Plants in the United States," by Mr. B. C. Washington, Jr.; April 25, "Design of Electromagnetic Mechanism, with Especial Reference to High Frequency Telegraphic Receivers," by Prof. Reginald A. Fessenden; May 23, "Electrical Clocks, Historically Considered; with a description of the Most Successful Applications of Electricity to Clocks and the Uniform Distribution of Time," by Mr. James Hamblett. On February 10 Mr. T. Commerford Martin will deliver a lecture under the joint patronage of the institute and the Central Branch of the Y. M. C. A. on the subject of "Electric Power Transmission."

Legal Notes.

LIMITATION OF DEBT.—A debt for the purchase of an electric light plant for a municipal corporation is not one of the "necessary expenses" of the town, within the meaning of Constitution, Art. 7, Sec. 7, so that it can be created without a vote of the majority of the qualified voters and legislative authority. Mayo v. Town of Washington, North Carolina Supreme Court, 1898.

TAXING PATENTS AS PROPERTY.—The Court of Appeals has affirmed the decision of the Appellate Division of the Supreme Court vacating the assessment imposed upon the capital stock of the Edison Electric Illuminating Company of Brooklyn, which assessment included the "value of certain patent rights." Chief Justice Parker, in his opinion, states that patent rights are not taxable by the State. The assessed valuation placed upon the Edison Company's patent rights by the assessors was $945,000.

COMPARATIVE NEGLIGENCE.—When both parties are negligent, the true rule is held to be that the party who last has a clear opportunity to avoid the accident, notwithstanding the negligence of his opponent, is considered solely responsible for it. Hence, a recovery may be had for an injury occasioned by a street railway employee's omission, after becoming aware of the plaintiff's danger, to use ordinary care for the purpose of avaiding the injury to him. Thompson v. Salt Lake Rapid Transit Company, Utah Supreme Court, 1898.

FREE EXHIBITIONS.—The risk of injury from careless handling of the implements used by the performers on a stage in an exhibition of target practice, even though given by an independent contractor to the patrons of the street railway company, is not, as matter of law, assumed by a patron of the street car company who attends the exhibition given by the company, and he may recover from the street car company for an injury received from a shattered bullet. Thompson v. Haverhill Street Railway Company, Massachusetts Supreme Court, 1898.

Personal Notes.

MR. E. I. GARFIELD has severed his connection with the Fort Wayne Electric Corporation, as New England representative, and is now with the Boston Electric Light Company, at 74 Ames Building, Boston.

DR. S. S. WHEELER, president of the Crocker-Wheeler Electric Company, New York, was married on the afternoon of October 11 to Miss Amy Sutton, at the home of the bride, in Rye, N. Y. Dr. Wheeler's many friends extend congratulations, and wish him and his bride a long life of happiness.

Trade and Industrial Notes.

THE STOREY MOTOR & TOOL COMPANY, Philadelphia, Pa., has moved its business to 464 South Broad Street, Trenton, N. J.

MR. WILLIAM MUELLER, 713-715 Burling Street, Chicago, well known to the electrical supply business, has secured the agency for the R. C. Demary quick break switch for the city of Chicago and vicinity.

THE CENTRAL ELECTRIC COMPANY, Chicago, in addition to its regular large stock of all kinds of standard and special telephone wires, states that it is carrying full stocks in all sizes of special tinned annunciator wire for telephone switchboard work.

MESSRS. ZIMDARS & HUNT, 127 Fifth Avenue, New York, report a heavy demand for their general catalogue, just issued. One of the features that make this catalogue exceptionally valuable is the completeness of the illustrations, the list of sizes and prices, and general information regarding panel and feeder boards.

THE LIPPINCOTT STEAM SPECIALTY COMPANY has been organized in New York to manufacture steam engine indicators, oil filters and a full line of engine and steam supplies. The company's headquarters are at 169 Broadway, and a copy of its catalogue will be sent to engineers on application. Mr. A. C. Lippincott is preparing an indicator instruction book for distribution among engineers.

THE AMERICAN ELECTRICAL HEATER COMPANY, Detroit, Mich., is selling a great many of its new design portable electric heaters, No. 180. The height of this little heater is 22 inches, and the diameter of the jacket is 9 inches. Its simplicity and efficiency, together with the good workmanship and reasonable prices asked, are responsible for its popularity. The company has had a great deal of experience in portable electric heaters.

THE MONTAUK MULTIPHASE CABLE COMPANY, 100 Broadway, New York, will ship a large order of its Montauk cable, to be used by the Milwaukee Auxiliary Fire Alarm Company in installing the fire alarm telegraph system for the city of Detroit. Chief Foley, of the fire department of that city, gave orders that this wire should be used. Superintendent Glassner of the fire alarm telegraph of the same city also indorses the cable for that purpose.

A NEW CONE PULLEY.—An ingenious belt drive with an adjustable velocity ratio has been put on the market by the Penn Electric & Manufacturing Company, of Wilkinsburg, Pa. The device uses a V-shaped belt running in pulleys, each of which has something the form of an hour glass. These pulleys are collapsible in such a way that the diameter at the waist may be varied, one increasing as the other decreases, thus maintaining a constant belt tension with a variable ratio of diameters.

THE KNIGHTS TEMPLAR IN PITTSBURG.—The programme for the entertainment of the Knights Templar, which meet in triennial conclave at Pittsburg October 11-15, includes excursions on Wednesday and Thursday, October 12 and 13, to Homestead, Duquesne, Wilmerding, East Pittsburg and Bessemer, at each of which places large iron and other industries will be visited. At East Pittsburg an hour each afternoon will be spent at the works of the Westinghouse Electric & Manufacturing Company.

THE ELECTRIC APPLIANCE COMPANY, Chicago, is calling attention to its new self-contained automatic hook, which the company states is of its own design and for which strong claims are made. It is easy to install and occupies little space. The contacts are visible when the door is opened, which makes it easy at any time to see that everything is in working order. The hook

is constructed with a cam at the back to prevent the lever being bent back out of shape. This hook is apparently a very desirable article.

MR. WILLIAM ROCHE, 259 Greenwich Street, New York City, is meeting with much success with his new "Standard Dry Battery." The United States Navy, whose requirements for all apparatus and supplies are always most rigid and decided upon only after careful tests, has placed large orders for the special A1 cell. Such an order alone is a sufficient testimonial to the qualities of the new battery. Mr. Roche reports orders multiplying to such an extent that it has become necessary to increase from time to time his facilities for the production of these batteries.

TELEPHONE CATALOGUE.—A very complete catalogue of telephone apparatus and construction material has just been issued by the Electric Appliance Company, Chicago, Ill. The American telephone switchboard is the first thing described and illustrated, and about everything in the way of telephone apparatus and construction tools is listed. Each article is designated by a code word to be used in ordering by telegraph, and for convenience in ordering by mail a trade number is given to each. A copy of the catalogue should be in the hands of everyone interested. It is well planned and executed.

TELEPHONE AND PROGRAMME CLOCK SYSTEM.—The State Normal School at River Falls, Wis., has been equipped with a complete telephone and electric programme clock system. The work was done by the Julius Andrae & Sons Company, Milwaukee, and is said to be perfectly arranged. The programme clock works automatically, announcing the exact time of new studies for the various classes, as well as indicating the department in which they will be held. In the superintendent's office is a switchboard, which enables him to communicate with any department of the large school without leaving his desk.

MACHINE TOOLS.—Screw machines, hand lathes, gear cutters, tapping machines, drill presses, universal and plane milling machines and other lines of machine tools are briefly described and well illustrated in a very complete catalogue just issued by the Garvin Machine Company, Spring and Varick Streets, New York City. The catalogue contains 126 pages, and its contents are carefully indexed. The dimensions of each machine illustrated are given, together with a brief description of its construction. The Garvin Machine Company has excellent facilities for the construction of both large and small tools, and its equipment is modern throughout. The size of the catalogue is 4 by 6 inches.

THE PETITE ENCLOSED ARC LAMP.— A catalogue very prettily illustrated and artistically executed in its general get up has been issued by the Western Electric Company, Chicago, to show the handsome designs of its Petite enclosed long-burning arc lamp. These lamps are made in different classes and types for direct-current service, and are adjusted for 110 or 220 volts. They burn from 130 to 150 hours on one trimming. The enclosing globes are made in a variety of ornamental forms, as well as in the standard form, and present a very handsome appearance. They are made in clear glass, opal and Redtag, the last being for inside use on 220 volts, burning singly. At the back of the catalogue are given carefully prepared directions for the trimming and general care of the Petite lamps.

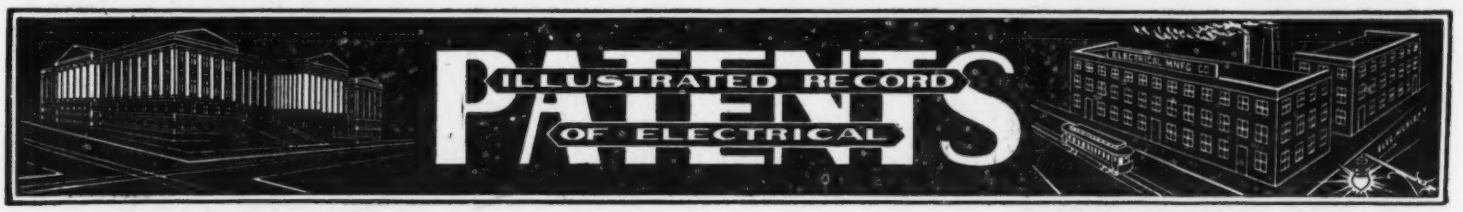
THE GOUBERT MANUFACTURING COMPANY, New York City, manufacturer of the Goubert feed-water heater, reports that it is exceedingly busy. Among the orders recently booked for heaters to go in steam plants are the following: One 3000-hp heater for the Cleveland Railway Company, Cleveland, Ohio; one 5000-hp auxiliary heater, for the Metropolitan Street Railway Company, New York City, making 35,000 horse-power now building for that company alone; and one 3000-hp heater for one of the New York & Pennsylvania Company's pulp mills. The company has just delivered 3000-hp to the People's Electric Light Company, Newark, N. J. These orders, in addition to regular calls for heaters of smaller sizes—among them being 1000 horse-power for the Schenectady Street Railway Company, Schenectady, N. Y., and 1800 horse-power for the Citizens Light & Power Company, Houston, Tex.—are indicative of the magnitude of the business done by the Goubert Company.

THE RASTER CARBON RHEOSTAT COMPANY, of Chicago, asks THE ELECTRICAL WORLD to say that it is not the company referred to in the circular letter sent out some little time ago by the Cutler-Hammer Manufacturing Company, of the same city, to the effect that a certain Chicago manufacuring company was about to put upon the market a rheostat an exact duplicate of its own and an infringement of its patents Nos. 418,678, issued January 7, 1890, and 368,804, issued August 23, 1887. The letter states that the circular letter referred to an entirely different manufacturing company in Chicago. The Raster Company adds that it has acquired a legal right to the use of patent No. 577,036, issued to Mr. Charles D. Jenney, on February 14, 1897, for an electrical switch as applied to an automatic motor starting box. The Raster Company says that this Jenney patent has been held by the United States Court in Indiana, in a case heard October 29, 1897, to be valid and not infringe the Cutler-Hammer rights in any way. Purchasers, therefore, it is claimed, run absolutely no risk in handling any of the Raster Company's goods, as its patents are valid and fundamental, and as it has the legal right to the use of patent No. 577,036.

Business Notices.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 9-15 Murray Street, New York City.

HAWAII AND THE PHILIPPINES.—Send 4 cents (in stamps) for an illustrated booklet issued by the Chicago, Milwaukee & St. Paul Railway, the direct route across the American continent to the new trans-Pacific possessions of the United States. Full of latest reliable information and valuable for reference. Can be used as a text book in school. Address William Kelly, Jr., G. E. P. A., 381 Broadway, New York.



UNITED STATES PATENTS ISSUED OCTOBER 4, 1898.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

611,601. ELECTRIC ARC LAMP; S. Bergmann, of New York, N. Y. App. filed July 10, 1897. An adjustable electrical resistance, consisting of a series of resistance coils arranged in one or more loops, and a movable metallic clamp engaging the two portions of the loop and capable of adjustment along said loop, whereby a greater or less portion of said loop of resistance coils may be cut out of the circuits, substantially as described.

611,638. SIGNAL APPARATUS; H. G. Leopold, of New York, N. Y. App. filed Sept. 3, 1897. In a signaling system, the combination of a controller, a signaling circuit, a series of order signals located at a distance and in shunt relation to said circuit; a telltale device included in said circuit, and located at the sending station; an open circuit around the controller; a recording device and a series of devices corresponding in number with the order signals and adapted to be actuated by the current traversing the signal circuit to close said open circuit around the controller and energize the recording device.

611,707. ELECTRICAL CONNECTOR; J. Pedriali, of Brussels, Belgium. App. filed March 30, 1898. An electrical connector, consisting of male and female parts, the former consisting of a handle of insulating material provided with a plug projecting therefrom, and carrying at its extremity an enlargement or head, and the latter consisting of a hollow plug or insulating material, and containing a U-shaped spring, the extremities of which are provided with contact plates between and beyond which the head of the plug passes, said U-shaped spring being reinforced by other springs located each side thereof, substantially as described.

611,719. ELECTRICAL CIRCUIT CONTROLLER; N. Tesla, of New York, N. Y. App. filed Dec. 10, 1897. The combination with a closed receptacle, of a circuit controller contained therein, and surrounded by an inert insulating medium under pressure.

611,722. ELECTRIC MEASURING INSTRUMENT; Ed. Weston, of Newark, N. J. App. filed Jan. 10, 1898. In an electrical measuring instrument, provided with a movable coil, pivot supporting plates having axially drilled holes, in combination with pivot pins or bearings secured therein by forcing them endwise, substantially as described.

611,723. INDEX NEEDLE OR HAND FOR ELECTRICAL MEASURING INSTRUMENTS; Ed. Weston, of Newark, N. J. App. filed Jan. 10, 1898. A pointer for an index needle, constructed of thin sheet metal, having substantially the contour shown and a raised stiffening of substantially the same contour.

611,724. ELECTROMETER; Ed. Weston, of Newark, N. J. App. filed Feb. 14, 1898. In an electrometer, a hollow pivot shaft, having secured thereto an electrostatic armature or needle and an indicating needle, the indicating needle being electrically insulated from the shaft, substantially as described.

611,752. TROLLEY EAR; H. Geisenhoner, of Schenectady, N. Y. App. filed July 15, 1898. A trolley ear, which is secured to the trolley wire by compressing the metal forming the wire around the ear.

611,760. SURFACE CONTACT RAILWAY SYSTEM; W. B. Potter, of Schenectady, N. Y. App. filed Nov. 29, 1897. In a surface contact railway, a feeder, sectional conductors or studs arranged in two sets, one furnishing current to the motor, the other upon the negative side of the system, and electromagnetic connecting switches; in combination with a movable vehicle varying motors, sliding contacts upon the vehicle for each of the sets of sectional conductors, a testing contact in the line of positive studs and in circuit with a circuit-breaker upon the vehicle in the main motor-lead, and an indicating device actuated by the said circuit-breaker.

611,766. DEVICE FOR SUSPENDING ARC LAMPS; J. Borka, of Buffalo, N. Y. App. filed March 4, 1898. A device for suspending an electric lamp from a pole consisting of a plate removably secured to the pole, sockets integral with the plate, a cylindrical rod removably secured in such sockets, a pair of tubular supporting arms journaled upon the cylindrical rod outside of its sockets, a casing integral with the plate and between the sockets, a pulley journaled in such casing, a frame in which the outer ends of the tubular supporting arms are connected, a pulley in such frame, a tie rod secured at one end to such frame and removably secured at its other end to the pole, and a cord passing over both pulleys for operating the suspended lamp, all combined and operating substantially as stated.

611,778. ELECTRIC RAILWAY; J. B. Entz, of Philadelphia, Pa. App. filed Dec. 21, 1895. In an electric railway, the combination of a rotary transformer having its alternating current end adapted to develop the average power required for driving a motor car or locomotive, and having its direct current end connected with a storage battery, which compensates for variations from the average load, a motor car or locomotive carrying said apparatus and having its driving wheels mechanically connected with the rotary transformer power station apparatus generating alternating current

and having line or working circuit connections extending along the railway, converters, means for supplying current from said line or working circuit to the alternating current end of the transformer, and devices for including and excluding the rotary transformer in and from the line or working circuit, whereby the alternating current on the line or working circuit and on the power station apparatus is kept uniform, thus permitting of the installation of the latter for the average load, substantially as described.

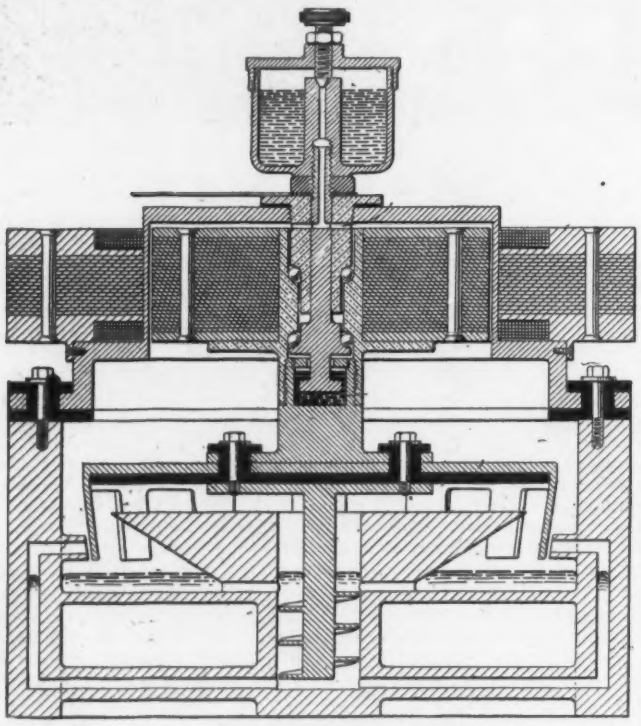
611,809. ELECTRIC METER; S. Evershed, of London, Eng. App. filed Dec. 21, 1897. In a motor meter, a vertical rotative axle, a self-actuated counting train, and means upon the said axle to control the speed or escapement of said train, substantially as described.

611,821. ELECTRIC RAILWAY CONDUIT AND TROLLEY; J. H. Robertson, of New York, N. Y. App. filed Oct. 20, 1896. The combination with a box fixed to a car and box frame, having a laterally yielding connection with said box and provided with contact plates, of a trolley arm provided with yielding contact pieces and means for removably connecting the trolley arm with said yielding box frame.

611,822. ELECTRIC TIME SWITCH; F. M. Schmidt, J. H. Gerry and W. S. Barstow, of New York, N. Y. App. filed Nov. 18, 1897. In a system of electrical distribution, the combination with an electric supply circuit and an electric consumption circuit, of a switch controlling the supply current to the latter circuit and an electric self-winding clock energized from said supply circuit, and controlling the operation of said switch to open and close the safe.

611,850. ELECTROMAGNETIC ENGINE; P. B. Watson, of Philadelphia, Pa. App. filed May 9, 1898. In an electromagnetic engine, a casing or housing, consisting of an upper and lower compartment, a horizontal intermediate division wall or partition therebetween, bearing on said partition a shaft mounted in said bearings, an armature adapted to rock in unison with said shaft, field magnets arranged in pairs in said upper and lower compartments, the heels or ends of said magnets being inclined to each other, the heels of the upper pair of magnets diverging upwardly and the heels of the lower pair of said magnets diverging downwardly, a cut-off having connections common thereto to said batteries and magnets, said cut-off having a lever, a contact on either side of said lever, conductors leading from said contact to said magnets, the latter having conductors common thereto, a slotted link or pitman adapted to be actuated in unison with said armature, the reciprocation of said link being imparted to said lever and crank shaft, and a pitman common to said crank shaft and to an extremity of said armature.

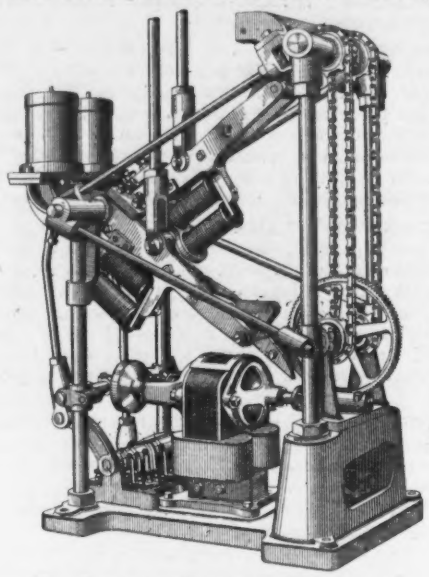
611,869. AUTOMATIC SWITCH APPARATUS; A. Schlatter, of Buda-Pesth, Austria-Hungary. App. filed Sept. 21, 1897. An automatic transformer switch apparatus having a switch lever and a controlling electromagnet therefor, in combination with an auxiliary magnet whose armature is provided with a catch for holding the switch lever, and whose circuit is connected with the circuit through said switching electromagnet, and a resistance included in the said circuit of such a nature that its value is reduced on heating, substantially as described.



No. 611,719.—Electrical Circuit Controller.

611,894. SIGNALING; J. P. Coleman, of Edgewood Park, Pa. App. filed Jan. 3, 1898. In a signal apparatus, the combination of a signal having a bias to danger position, a motor for clearing the signal, an electrically controlled slot mechanism for detachably connecting the motor to the signal, the several parts of such slot mechanism being constructed so that each will automatically move out of its holding position on the de-energizing of the magnet of the slot, substantially as described.

611,897. ELECTRIC SIGNAL DEVICE FOR RAILWAYS; T. Dube, of Paris, France. App. filed Dec. 6, 1897. An electric signal for railways consisting of the rail-sections overlapping one another, two series of electrical conductors extended along parallel to the rails, two sources of electric supply carried by each locomotive, each having its circuit formed through trolley wheels carried by the locomotive engaging respectively with one of the electric conductors, current reversing mechanism carried by each locomotive and interposed in the same circuit whereby alternating currents are sent through this circuit, and an electric bell carried by each locomotive and interposed within said circuit, the other circuit being so arranged that the trolley wheels traveling in one direction have a reverse polarity from the



No. 611,943.—Railway Signaling.

trolley wheel traveling in the opposite directions, and an electric bell carried by each locomotive and interposed in this circuit, substantially as described.

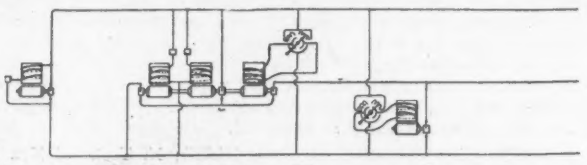
611,902. APPARATUS FOR ADJUSTING PHASES OF ALTERNATING CURRENTS; Johannes H. F. Gorges, Berlin, Germany. App. filed Dec. 27, 1897. The combination with a source of alternating current of a series circuit wherein the current flowing is derived from said alternating current and substantially coincides in phase therewith, a Wheatstone bridge circuit having branches, a circuit bridge across the terminals of said Wheatstone bridge circuit, resistances included in the sides of said Wheatstone bridge circuit, and phase modifying means included in the sides thereof.

611,919. TELEGRAPH KEY; F. E. Lewis, of Jefferson, Tex. App. filed Dec. 2, 1897. The key base, the upright bearing posts, and the key lever spring stamped from sheet metal and bent to proper shape, substantially as described.

611,927. MULTIPLE RATE METERING SYSTEM; F. T. McIntyre, of Washington, D. C. App. filed March 25, 1898. In a multiple metering system of electrical distribution, the combination with two independent meters having their register controlling elements connected in independent branches, or the distributing mains of independent control wires connecting said branches with the distant central or control station, and a switch mechanism for completing the circuit through one or the other of said control wires and meter in circuit therewith, substantially as described.

611,943. RAILWAY SIGNALING; K. G. Schreudern, of Edgewood Park, Pa. App. filed Jan. 3, 1898. In a signaling apparatus, the combination of signals, a motor for shifting said signals, independent connections from the signals to the motor, a lock for holding each signal in clear position, a magnet controlling each signal connection and lock, and a track circuit controlling the circuits of the motor and of the controlling magnets.

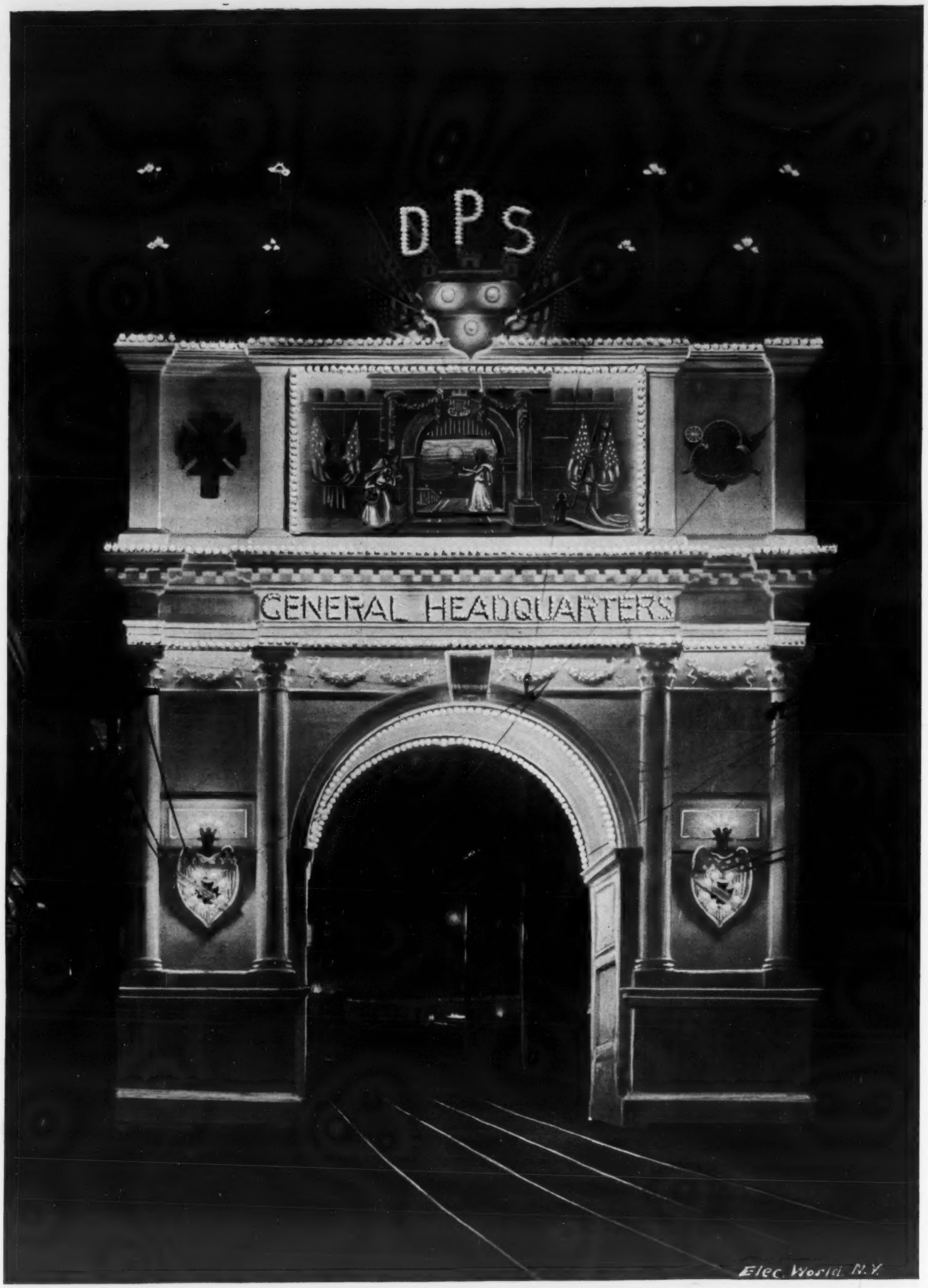
611,970. METHOD OF AND MEANS FOR CONTROLLING ENERGY DELIVERED TO TRANSLATING DEVICES; H. P. Leonard, of East Orange, N. J. App. filed Jan. 21, 1896. In a system of electrical distribution, the combination with the main conductors, each having a practically constant but different potential, an e. m. f. producing device connected therewith which develops a constant intermediate potential, a variable e. m. f. producing device having one terminal connected to the constant inter-



No. 611,970.—Method of and Means for Controlling Energy Delivered to Translating Devices.

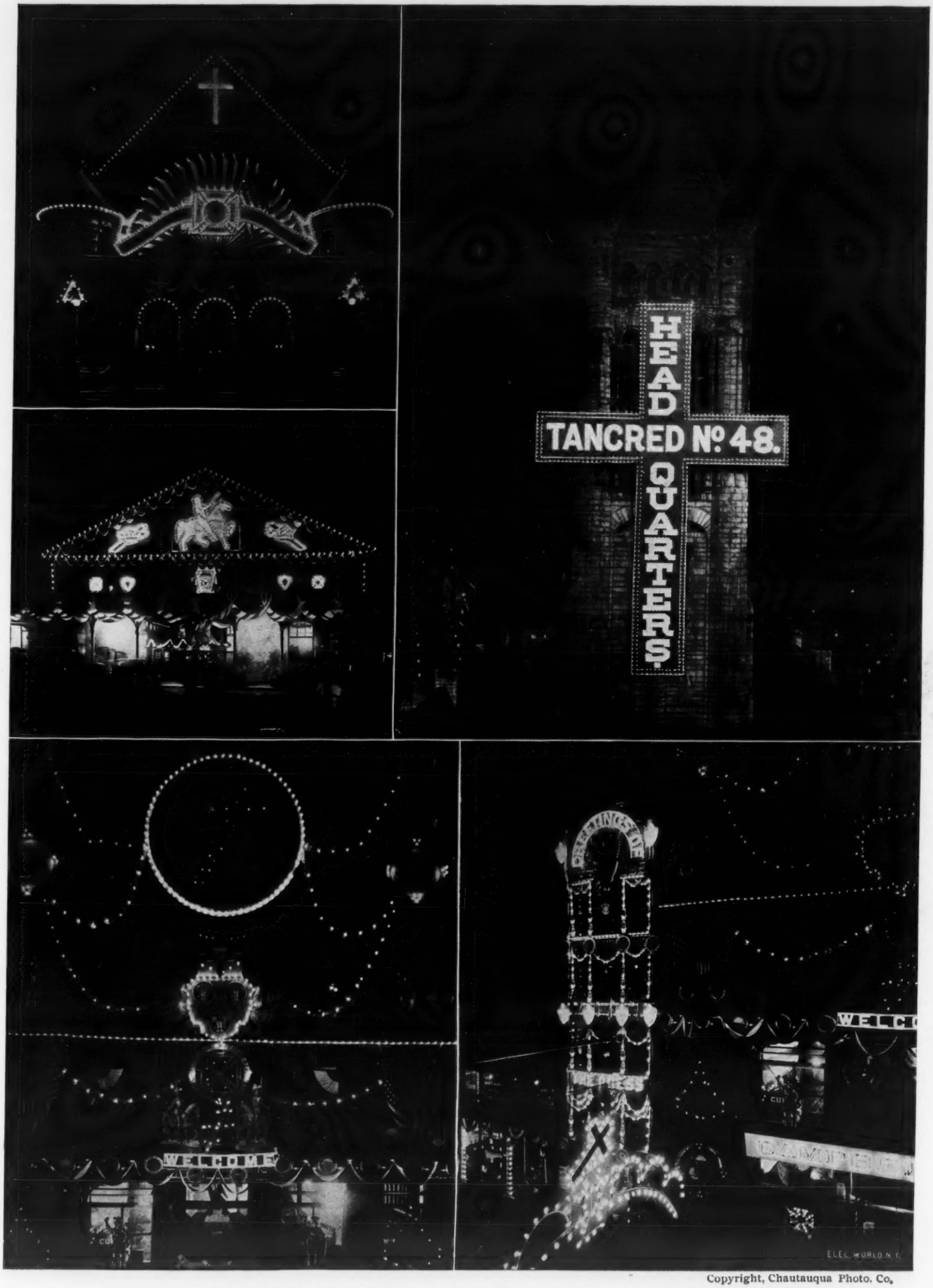
mediate potential, and a conductor extending from the other terminal of said variable e. m. f. producing device, between which and one of the main conductors translating devices are adapted to be connected substantially as described.

611,974. AUTOMATIC SWITCHING AND TELEPHONE SYSTEM; L. G. Nilson, of Sioux City, Ia. App. filed March 9, 1896. In a box adapted to transmit electrical impulses, consisting of an escape wheel, a balance, two slidable pallets adapted to impart an oscillatory movement to the balance by being screwed upon by the escape wheel.



ARCH SPANNING SIXTH AVENUE, IN FRONT OF PUBLIC SAFETY BUILDING.

The Illumination of Pittsburg for the Knights-Templar Conclave.



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